MACHINERY

Design—Construction—Operation

Volume 41 MAY, 1935 Number 9

Efficient methods of transporting work and materials within a plant are necessary if the machines and their operators are to be kept busy. How tractors and trailers keep work moving in a large automobile plant is the subject of the leading article in June MACHINERY. Other subjects to be covered are new methods of making molds for plastic materials; ball bearings for live centers; alloy steels for dies and tools; and some recent welding developments.

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 584-D

New Industry Creates Demand for Light Machinery
By Charles O. Herb 521

Heating, Quenching and Drawing in Automatic Furnaces
By J. B. Nealey 526

Boring Small Tapered Holes to Close Tolerances..... 530

Selecting the Right Machine Tool for the Job
By Walter K. Bailey 532

Die-Casting Dies that Achieve the Impossible
By Charles O. Herb 534

Editorial Comment 538

Diamond Boring of Automobile Pistons....*By C. A. Birkebak* 544

Cutting Rotors from 12-Inch Steel Plate with Oxy-Acetylene.. 551

Milling Machine Units and Fixtures Designed for High Production.....*By H. J. Dods* 554

Electric Arc Provides New Type of Cutting Tool..... 558

Long Service Records in the Chevrolet Plants..... 580

DEPARTMENTS

Ingenious Mechanical Movements 539

Engineering News Flashes 542

Design of Tools and Fixtures..... 547

Questions and Answers 552

Materials of Industry..... 560

New Trade Literature 562

Shop Equipment News 565

News of the Industry..... 584

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Product Index 116-132

Advertisers Index 134

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MACHINERY

Volume 41 NEW YORK, MAY, 1935 Number 9

New Industry Creates Demand for Light Machinery

By CHARLES O. HERB

Synthetic Plastics Are Turned, Bored, Sawed and Otherwise Machined into a Thousand Different Objects

Machines Designed Especially for Cutting Plastic Materials would be of Aid to This Growing Industry

THE development of a new industry nearly always creates a demand for new equipment or machines. In the last few years, the manufacture of synthetic plastic products has grown to such proportions as to suggest the need for lighter types of machines. At the present time, hundreds of thousands of parts are produced daily from bars and shapes of synthetic plastics by machine tools that are designed for metal cutting. These machines are unnecessarily heavy, do not provide the most suitable speeds and feeds for machining the light plastic materials, and are furnished with more or less expensive features that are not required for the work to be done. But they must be used until machines designed specifically for cutting plastic materials become available.

Automatic screw machines, lathes, drilling machines, band saws, cutting-off machines, and polishing machines are typical equipment employed in the plants of this growing industry, which already includes a number of establishments having hundreds of employes. How this equipment is being used in plastic-product factories will be apparent from the operation pictures shown in this article, which were taken in the demonstration shop of the American Catalin Corporation, New York City.

Fig. 1. An Attractive Clock Housing Made from Phenolic Plastics. The Case is of Yellow "Onyx" Catalin, Mounted on a Black Base of the Same Material

Beauty and usefulness seem to be almost inseparable companions in the products of the synthetic plastics industry. Colors that rival the brilliant hues of the rainbow are now available for such commonplace things as the handles of kitchen utensils or mechanics' tools. Articles of personal adornment that compare favorably in appearance with costly jewelry, have been brought within the means of everyone.

Catalin, the phenolic resin made by the American Catalin Corporation, is available in two hundred standard colors—opaque, transparent, translucent, mottled, or delicately grained. Beautiful effects can be obtained by using this material in one color or in a combination of hues, as in the case of the electric clock shown in Fig. 1. The housing of this clock is an attractive yellow "onyx," mounted on a jet-black base made up of sheet and rod Catalin.

Synthetic plastics can be divided into two general classifications—the older phenol-formaldehyde resins, and the newer urea-formaldehyde compounds. The phenolic resins can be subdivided into two groups. One group is used in powder form for the manufacture of articles of endless variety. Predetermined amounts of powder are placed in alloy steel molds. The molds are then subjected to heat and pressure to form the parts.

The second group of phenolic plastics is poured in liquid form into open lead molds, as shown in Fig. 3, to produce finished "castings" of rods, tubes, sheets, and special shapes. These plastic castings can be cut up and machined into different forms for producing a wide variety of products. Catalin belongs to this group. The methods employed in manufacturing articles from this material will be described in this article.

The heading illustration shows an interesting collection of ornaments produced from rod, tube, and sheet Catalin. The material is first cut to approximately the desired length by means of a band or abrasive saw. It is then shaped in a small lathe or automatic screw machine, and finally polished

Fig. 2. Knobs of Many Styles are Turned, Bored, and Threaded in Lathes and Screw Machines

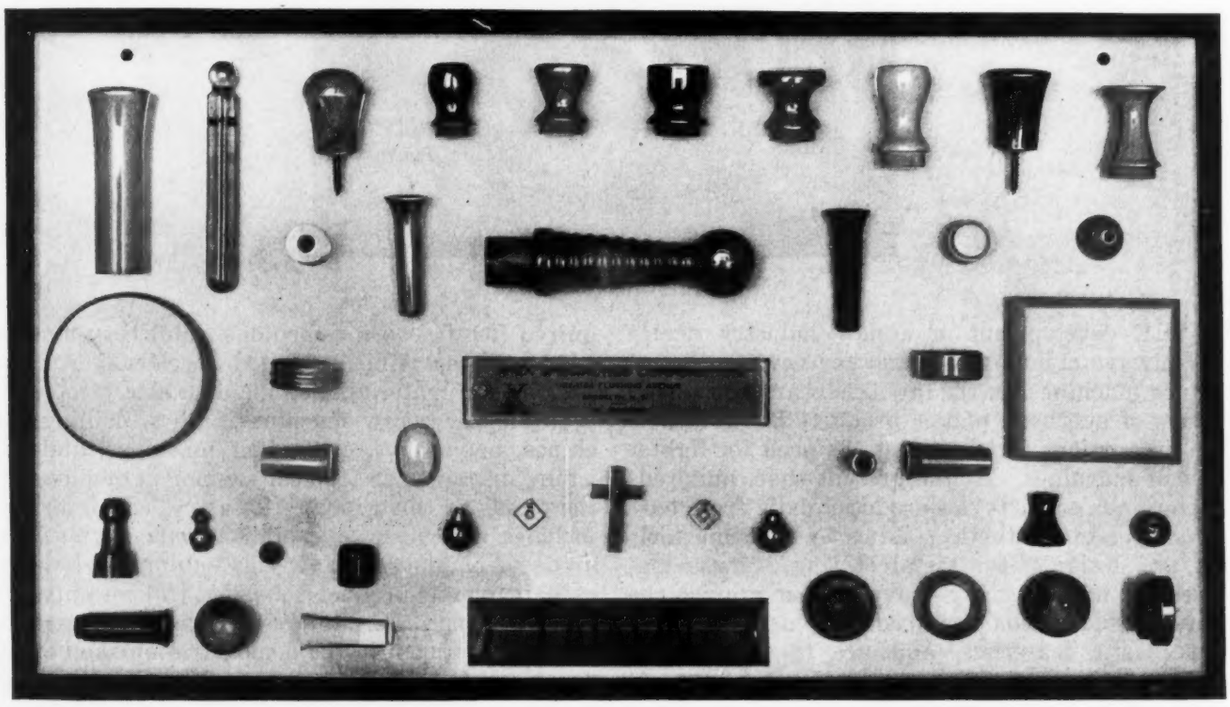


Fig. 3. Liquid Catalin is Poured into Molds to Form Rods, Tubes, Sheets and Special Shapes

to a high luster by buffing wheels. Offhand, it would hardly be thought that the string of "amber" beads or the artistic clock housing shown were products of light machine tools.

The "carving" on the "crystal" locket, bracelet, and earrings and on the ivory-like flower and other parts, is produced by means of minute grinding wheels and other tools similar to those used by the dental profession. The small plaque in the upper left-hand corner of the illustration consists of a rectangular sheet of white Catalin on which has been superimposed an intricate silhouette that was cut from a black sheet by means of a jig saw.

Candlesticks of many styles can be turned and bored in lathes from rod stock. Two such examples are shown in Fig. 4. The same illustration shows a pleasing cigarette case made up from onyx-like sheet material with short pieces of black round rod fastened to the corners. The poker chip rack was made of a single casting, but the red, white, and blue chips were cut off from rod in an automatic machine.

The clock housings were also made of individual castings because of the flange on their front faces. Had it not been for these flanges, they could have been cut in multiple from castings of the required shape.

Rods of this phenolic resin are made in diameters from 3/8 inch to 5 inches and in lengths from 12 to 22 inches, while tubes come in outer diameters from 3/4 inch to 8 inches and with walls from 1/8 to 1 inch thick. Castings of special shape are generally made in lengths from 6 to 15 inches, while sheet material is made in sizes up to 36 by 60 inches and in thicknesses from 1/16 to 1 inch.

The material can be machined with the same facility as brass or wood, and hence there is a big demand in the synthetic plastic field for light machines of automatic and semi-automatic design. A wide variety of work manufactured from rod stock in lathes and automatic screw machines is shown in Fig. 2. In a number of cases, threads are cut directly on the phenolic parts. In other cases, holes are drilled in the material to receive metal screws or other inserts. It is general practice to make the holes somewhat smaller in diameter than the inserts. Then, before assembling the inserts, the phenolic part is heated by immersing it in boiling water, which causes it to expand sufficiently to permit the inserts to be placed in the holes. When the part contracts to normal temperature, the inserts are held securely.

Sheet material can be cut to the required outlines on the band saw and smoothed on the sides and edges for use as umbrella handles, purse tops, lamp shades and bases, etc. When two or more pieces are used to construct an object, they may be fastened securely together by means of screws or glue. After dipping sheet material in boiling water, it can be bent with ease to the desired shape, and the part will retain its shape after the material cools.

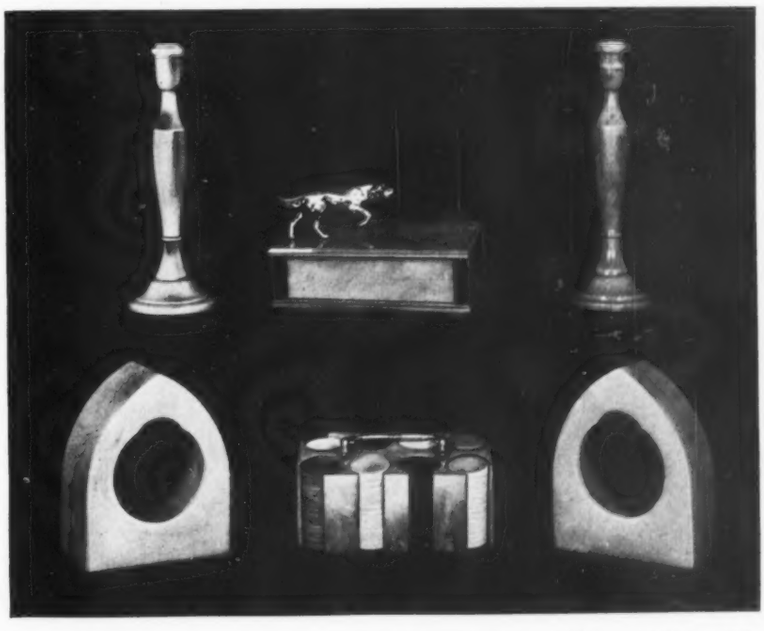


Fig. 4. Attractive Objects of Endless Variety Can be Produced from Phenolic Plastics

Fig. 5. The Band Saw is Used for Cutting Clock Housings and Similar Parts from Catalin Castings

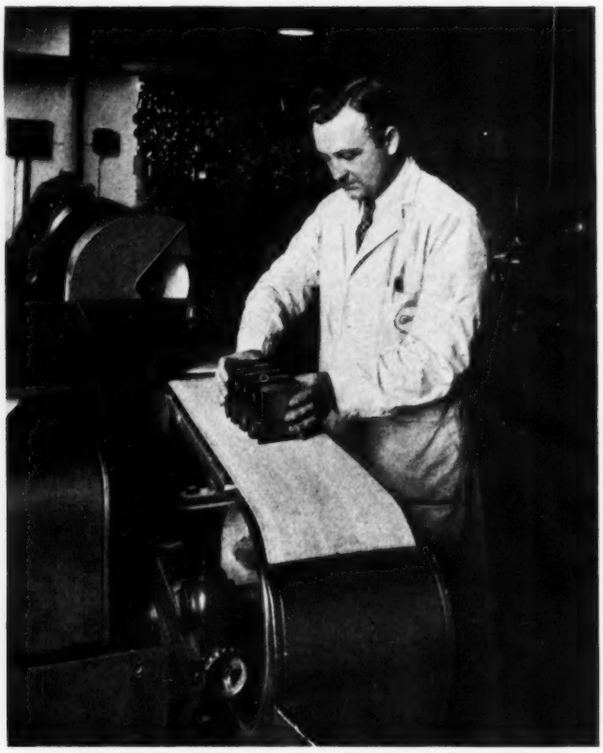
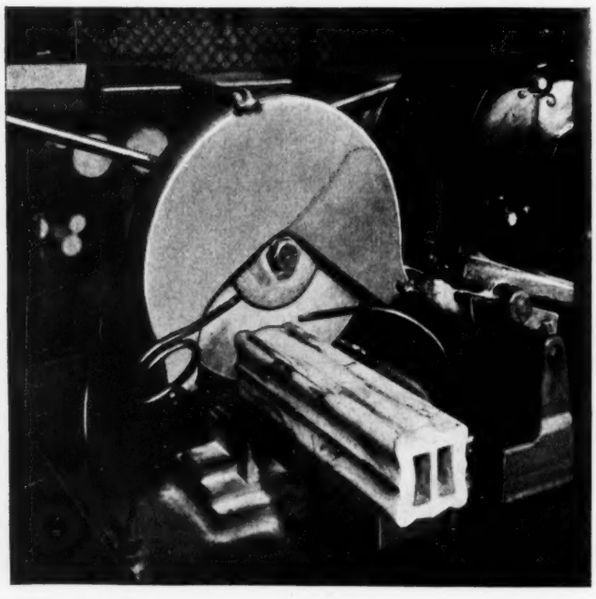


Fig. 6. Sawed Flat Surfaces are Smoothed off on a Sanding Machine Preliminary to Polishing

Fig. 7. The Abrasive Cut-off Saw is Important in Producing Thin Parts from Rods and Sheets

Fig. 8. Straight and Taper Turning, Boring, and Thread-cutting are Done in an Engine Lathe



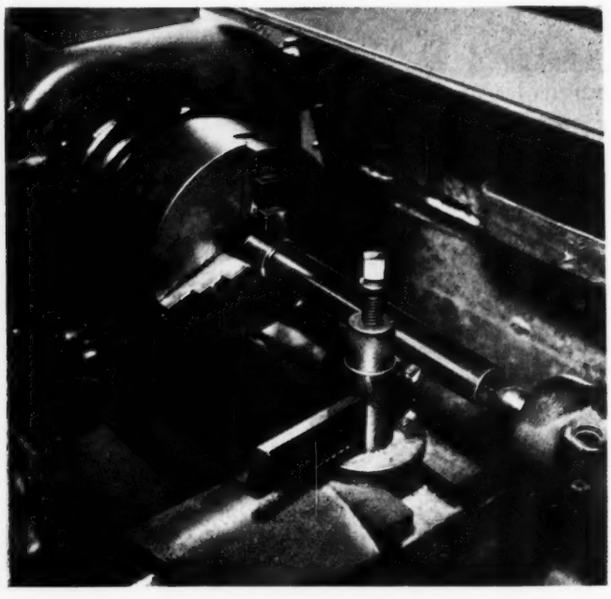


Fig. 9. Candlesticks and Other Parts of Irregular Contour are Shaped in a Wood-turning Lathe

Fig. 10. The First or Preliminary Step in Polishing a "Crystal" Ball on a Three-wheel Machine

In the demonstration shop of the American Catalin Corporation, samples of the products can be machined on short notice into any object that a customer may contemplate manufacturing. Fig. 5 shows a light band saw cutting clock housings from a plastic casting. Fig. 6 shows a poker chip rack being smoothed on a sanding machine equipped with a Carborundum belt, preparatory to polishing.

Small pieces, such as buttons and belt buckles, are cut from rod stock and special shapes in the abrasive cutting-off machine illustrated in Fig. 7. The small engine lathe shown in Fig. 8 is employed for straight or taper turning, thread cutting, and boring. Parts of irregular contour are formed on the wood-turning lathe seen in Fig. 9.

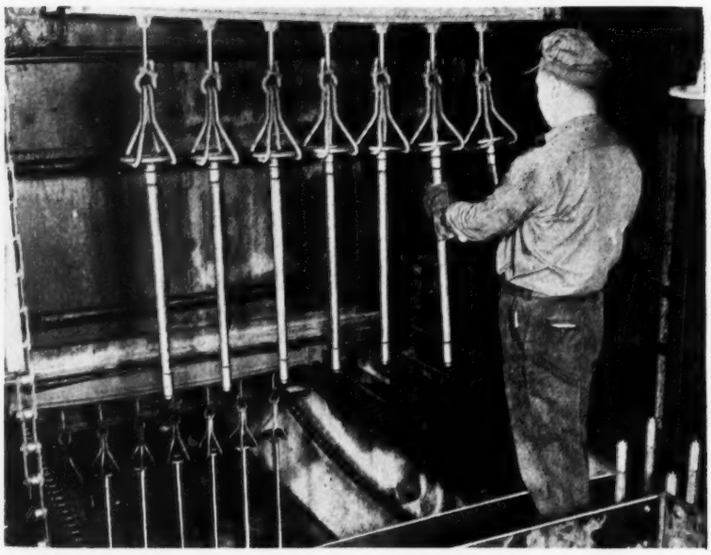
The three-wheel floor type polishing machine shown in Fig. 10 is employed to impart a high luster to these phenolic plastic parts. On the first wheel of this machine, wet pumice is employed to smooth all surfaces of the part. On the second wheel, bar wax is used for preliminary polishing. The third wheel is operated clean and dry to impart a high gloss to the work. All three wheels are of the loose-fabric type.

Old Electric Motors, Too, Should Be Replaced

Much has been said about the need for replacing machinery and shop equipment in order to obtain greater operating efficiency. What has been said about shop equipment in general is equally true of electric motors. The newer types of motors are far more efficient than many of the older ones. To be sure, the old motors run and deliver power; but how much does the power cost?

Some interesting data are available on a modernization program involving main-line shaft drives at the Sperry Flour Mill at South Vallejo, Calif. Two 15-year-old 400-horsepower wound-rotor induction motors were replaced by General Electric synchronous motors, resulting in a power saving of $300 a month. This, it is stated, returns about 33 per cent on the investment in the new motors.

Electric motors fifteen years old are considered comparatively new. Thousands of motors of much older design are running continuously and giving good service; but apparently it is well to have the efficiency of old motors looked into to make sure that the power they deliver is not too expensive.



Heating, Quenching Automatic

A Double-Chambered, Automatically Controlled Furnace Performs Final Heat-Treating Operations on Rear Axle

Fig. 1. Rear Axle Shafts, Loaded on Carriers, Pass through Furnaces Automatically, Returning to Same Point Completely Hardened and Drawn

THE final heat-treatment of automobile rear axle shafts includes three distinct operations consisting of heating, quenching, and drawing. Some time ago, this process was made semi-automatic by placing two continuous furnaces in tandem with the quench between them. Now a fully automatic unit has been developed which eliminates the necessity for handling or transferring the work from the quench to the drawing furnace.

The new unit, shown in the accompanying illustrations, consists of a double-chambered furnace, one chamber above the other. It is located in the Chevrolet Gear and Axle Plant, Detroit, Mich., where gears and axles are manufactured for all nine of the car assembly plants of this company. Each chamber or furnace is kept in continuous operation by a separate mechanical pusher. The upper furnace receives part of its heat from the lower one, which is gas-fired. Both furnaces are automatically controlled as to temperature, and hot air from a separate gas-fired heater is blown into the upper furnace in order to make the control complete.

The conveying of the axles from one furnace to the other and through the quench is accomplished by six loop-chain elevators and transfers, as shown diagrammatically in Fig. 3. The six individual motor drives for these elevators and transfers and the two motors for the pushers, eight motors in all, are synchronized and operate progressively through a time clock and master control. Furthermore, all the circuits are so interlocked as to stop the entire system in case trouble develops at any single point.

Fig. 1 shows the loading and discharge end of the double-deck furnace. The operator has unloaded the carrier and placed the heat-treated axles in the bin, and is reloading the fixture with axles taken from a chain conveyor close by. The previous carrier, with its load of axles, is seen in the pit, about to ascend into the furnace.

In Fig. 2 is shown the opposite end of the furnace. Here the axle shafts may be seen descending into the quenching oil in the opening beneath the furnace. Two carriers can be seen, each with seven axle shafts submerged in the oil. Another carrier is raising the axles from the quenching oil to carry them into the upper chamber of the furnace. The operations of the various conveyors are synchronized by means of limit switches, one of which is shown at the left. A pin on the large sprocket wheel of the chain drive actuates the vertical rod which carries a cam contacting with the roller of the switch.

The high-heat furnace is 40 feet long and 9 feet wide, while the other is a foot or two longer on each end. The combined height of the furnaces, from the floor to the roof, is 15 feet. They are built together in a single unit of brick and refractory shapes and are stayed with steel shapes. The lower furnace is fired with twenty gas burners on each side, eleven underfiring the work, and nine along the arch of the roof. Five more underfire also from the front.

The hot products of combustion flow directly into flues in the furnace walls that extend up past the upper furnace, and are discharged through a stack. The inner walls of the flues, where they pass the upper or low-heat furnace, consist of alloy plates through which much of the remaining heat is transferred. The heater furnishing the supplementary heat is of the conventional barrel type, with a gas burner in one end and a motor fan in the other, and is located on the roof of the unit.

The temperature of this furnace, as well as of the others in this division, is regulated by a central control room. Air under 1 1/2 pounds pressure delivered to the burners inspirates the gas in the

and Drawing in Furnaces

Shafts at Rapid Production Rates and Under Accurately Controlled Conditions in the Chevrolet Gear and Axle Plant

By J. B. NEALEY
American Gas Association

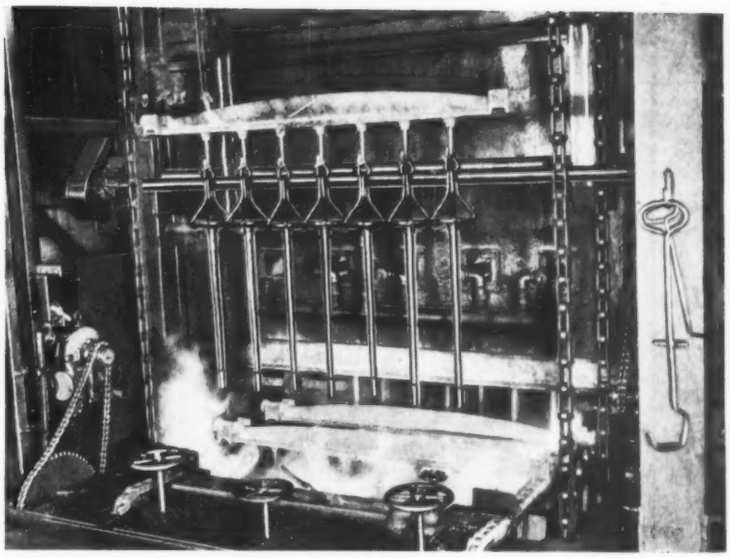


Fig. 2. End of Furnace Opposite Loading Position, Showing Heated Axles About to Enter Quenching Bath on Way Through Heat-treating Furnace

proper proportion for complete combustion. The air line leads through the control room, where a motor-operated valve is assembled in the pipe. In this way, the fuel supply to the burners is turned on and off, as the furnace requires more or less heat, through the thermo-couple and potentiometer controller. Temperature variations are charted on a recorder.

The axles are suspended from alloy beams or carriers, seven to a beam, as shown in Figs. 1 and 2. These beams ride on alloy rails, in the upper part of each furnace, and are pushed through by the mechanical pushers. Elevators and transfers handle them between the chambers. The cycle of operations of the mechanical system handling the axles requires about sixty-five seconds and is divided into two periods. First the two pushers and the two transfers, moving horizontally, are started, and as each runs for a different time interval they stop automatically when their individual limits are reached. Then the four elevators, moving vertically, start up all together and stop individually.

In the first operation, the two lines of carriers in the furnaces are pushed along one step while the two transfer chains move two carriers into positions from which they can be picked up by cups swinging from the elevator chains. In the second

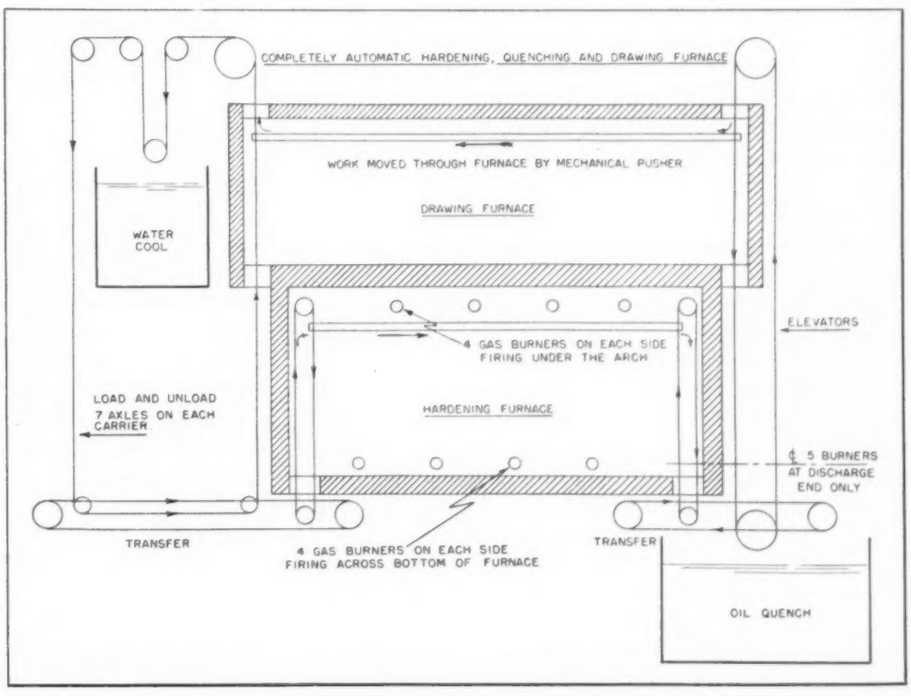

COMPLETELY AUTOMATIC HARDENING, QUENCHING AND DRAWING FURNACE
WORK MOVED THROUGH FURNACE BY MECHANICAL PUSHER
DRAWING FURNACE
WATER COOL
ELEVATORS
4 GAS BURNERS ON EACH SIDE FIRING UNDER THE ARCH
LOAD AND UNLOAD 7 AXLES ON EACH CARRIER
HARDENING FURNACE
5 BURNERS AT DISCHARGE END ONLY
TRANSFER
4 GAS BURNERS ON EACH SIDE FIRING ACROSS BOTTOM OF FURNACE
TRANSFER
OIL QUENCH

Fig. 3. Diagram Showing Conveying System Designed to Carry Rear Axle Shafts through Heat-treating Furnace Shown in Figs. 1 and 2

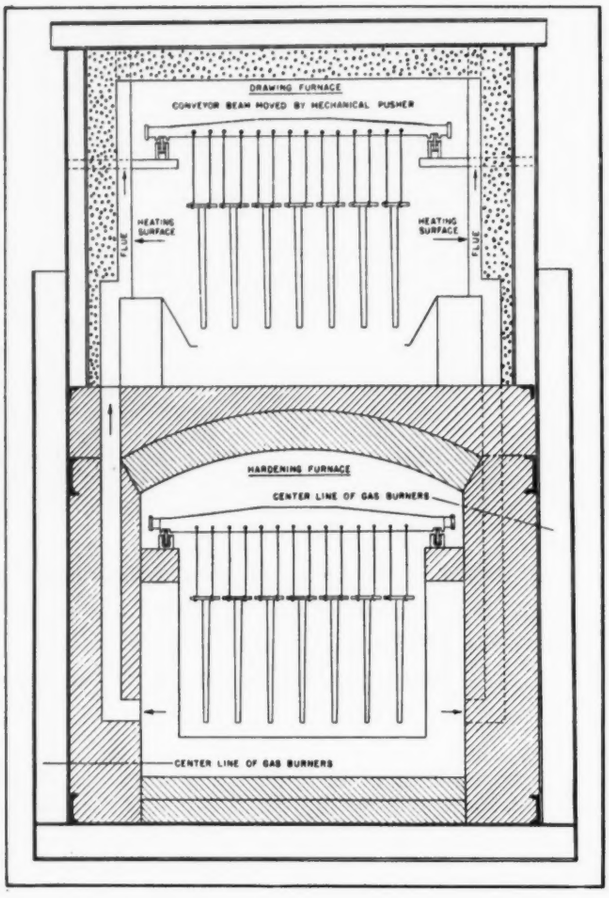


Fig. 4. Cross-section of Double-deck Heat-treating Furnace Shown in Figs. 1, 2, and 3

operation, the four elevators are started, as explained. Two of these are inside the high-heat furnace and move through openings in the bottom. The one at the charging end picks up a carrier from the transfer, moves it up into the furnace, and drops it on the rails. The one at the discharge end lifts a carrier from the rails and lowers it on the transfer with the axles hanging in the oil quench. At the same time, the outside elevator on the discharge end raises a carrier from the transfer, then lowers it into the upper furnace through a slot in the top, and finally deposits it on the rails at the charging end of the drawing furnace.

The outside elevator on the discharging end of the drawing furnace removes the carrier from the rails, lifts it through an opening in the top of the furnace and finally lowers it to a point where the axles are removed from the carrier. The axles are mechanically dipped in cold water during this last movement. This point also is the loading point, as the elevator extends down to the transfer which feeds the elevator in the charging end of the high-heat chamber. These axles are quenched in oil at 1550 degrees F. and are drawn at 980 degrees F.

New Method of Producing Tracings

A new process for reproducing any number of tracings from an original tracing has been developed recently. This process is known as the Litho tracing reproduction method. The Lake Photoprint Co., Inc., 19 S. Wells St., Chicago, Ill., which has installed equipment for making these tracing reproductions, furnishes the following information in regard to the application of the process.

Starting with an original tracing, any number of tracings can be reproduced that are as clear and distinct as the original tracing. New or old tracings can be used as originals with equally satisfactory results. The reproductions are usually made on tracing cloth like the originals, but they can also be made on paper if required. The reproduced tracing is non-smearing and non-shrinking. Widths up to 54 inches of any length can be handled.

The value of Litho tracing reproductions in the drafting-room and engineering department is most easily appreciated when it is considered that these Litho reproductions, made on tracing cloth at a rate of 50 cents per square foot, offer an opportunity to preserve the master tracings. The copies are used for reference by the draftsmen instead of the master tracings. Furthermore, the original or master tracings can be permanently kept in a fire-proof vault.

When changes are made in the original tracings, a new Litho copy can be made, and the result is a complete new tracing in first-class condition. Several manufacturers have already adopted the practice of making a Litho copy of every tracing as a matter of protection and to save the wear and tear on the master tracings.

* * *

The Development of the Lathe—An Industrial Motion Picture

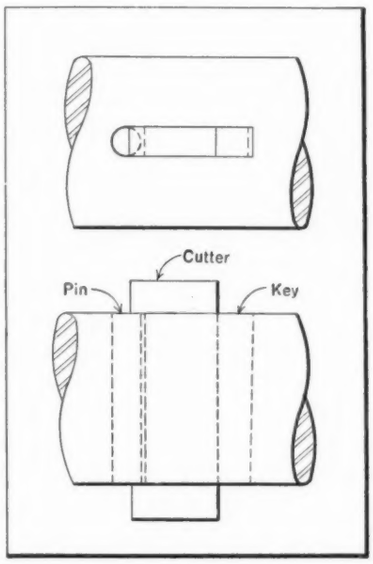
A new industrial film entitled "The Development of the Lathe" has been produced by the Monarch Machine Tool Co., Sidney, Ohio. This film pictures the original tree or pole lathe used at least 1500 years ago and shows its successive stages of development. It pictures the first wood screw cutting lathe of the fifteenth century, the first iron lathe of about the year 1800, the first quick-change gear lathe of 1890, and the first geared-head lathe of 1900. In addition, it pictures a number of Monarch machines in operation, including engine lathes, form-turning machines, automatic lathes, and surface grinders.

A limited number of these films are available in two sizes—about 1000 feet of 16-millimeter safety-type film, and about 2000 feet of 35-millimeter film. These are lent to industrial organizations, technical societies, and educational institutions, upon application to W. E. Whipp, Monarch Machine Tool Co., Sidney, Ohio.

Centralizing Cutters in Boring-Bars

By EDWARD PRINCE

Many boring-bar cutters have a gap at their back end for accurately centralizing them in the bar. However, as a rule, the cutter will not maintain its central position under a heavy uneven cut if the bar is soft, and to harden a long bar is generally beyond the capacity of an ordinary shop.



Centralizing a Boring-bar Cutter with the Ends of a Hardened Pin Ground in Position

In one shop, the bars are made in sizes up to 6 inches in diameter and 6 feet in length. Back of the cutter slot, a hole equal in diameter to the cutter thickness is drilled and reamed, as shown in the illustration. Into this hole is driven a hardened and ground pin. In grinding the bar, the pin is ground on its ends. The ends of the pin thus provide a hard seat for the projections formed by the gap on the cutter. It will not be necessary to mark the bar or cutter to indicate which way the cutter enters the bar, if sufficient care is taken in making the bar slots and cutter gap central and square. The cutter has line contact only, but that is sufficient to centralize it.

* * *

Welded-Head Construction for Cylindrical Containers Made from Steel Pipe

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

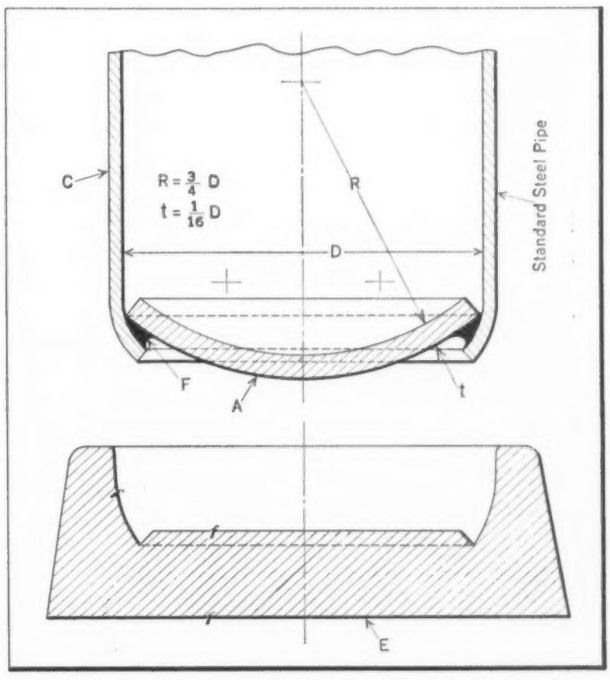
An interesting method of producing cylindrical containers known as "oil interceptors," which are used on ammonia compressors, is employed at the New Brunswick plant of the Carrier Engineering Corporation. The interceptors, made by welding steel heads to lengths of steel pipe as described here, are made in six sizes, the smallest size being made from 3-inch and the largest from 12-inch steel pipe. The formulas for the radius R of the steel head and the thickness t given in the accompanying illustration, are used for standard steel pipe up to 12 inches in diameter.

Two heads A are heated and formed in a press, one head being punched to receive a coupling, which is welded in place at the center of the head. The pipe or body C is received at the plant cut to length. A horizontal hydraulic press is used for forming both ends simultaneously, two dies like the one shown at E being required for each size of pipe. One die is fastened to the head end and the other to the tail end of the press by means of split rings tapered to fit the outside of the die. This tapered construction of the dies prevents them from being pulled out of the holders when backed off the work.

Two heads A are inserted in each pipe and the assembly then placed between the dies. The heads, being about 3/16 inch smaller than the inside diameter of the pipe, can be easily inserted. They are placed near the center of the pipe so that they will clear the dies during the forming operation. A line is scribed on each end of the pipe to show the operator when the pipe reaches the bottoms of the dies. This forming operation is performed without heating the pipe.

A hook is welded to each head before it is inserted in the pipe. This hook permits a counterweight suspended from the ceiling to be employed to hold the head in place while it is being welded at F. The pipe is held in a vertical position for welding, one end being welded at a time.

The dies E are made of machine steel and are pack-hardened. These dies have been used for about fifteen years. About 4000 containers of each of the six sizes have been made during this period. The finished tanks are tested with a pressure of 300 pounds per square inch.



(Upper View) Cross-section of Steel Pipe with End Closed by Welded Plate. (Lower View) Die for Forming End of Pipe to Shape Shown in Upper View

Boring Small Tapered Holes to Close Tolerances

SPINNING machines in textile mills are equipped with whorls of different styles. Several typical whorls are shown in Fig. 1. These parts are made of cast iron. An important requirement in the manufacture of these parts is that the small-diameter hole must be bored accurately at the inner end to a slight taper for a short length. This hole varies in size and amount of taper in different whorls. However, on one style, the hole is bored to a nominal diameter of 5/16 inch for a length of 3/8 inch and to a taper of 0.010 inch per inch. The tapered hole must be concentric with the outside surfaces of the whorl within 0.001 inch. From 0.004 to 0.005 inch of stock is removed in the operation, the hole having been previously drilled and reamed.

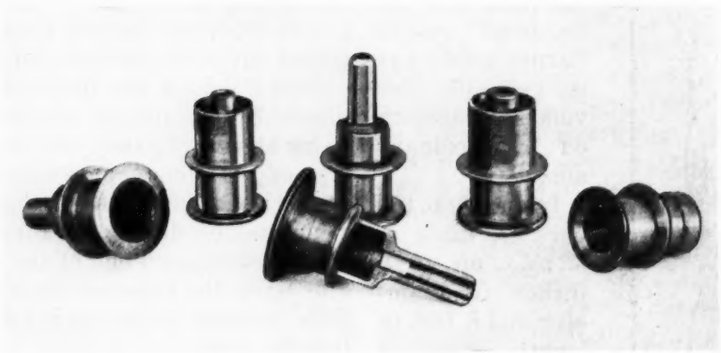


Fig. 1. Spinning-machine Whorls which Must be Accurately Bored to a Slight Taper in the Small-diameter Hole

This accurate boring operation is performed at production rates up to 260 pieces an hour by the use of a Heald Bore-Matic, arranged, as shown in Fig. 2, with two work-heads and a similar number of tool-holders. With this arrangement, the machine can be set up for "boreizing" two parts either of the same size or of different sizes. Tungsten-carbide tipped tools are used.

The machine is designed to take care of a considerable range of hole sizes and amounts of taper. As the work-heads are mounted on a swivel-plate fastened to the bridge, they can be swung in the horizontal plane to position the work-head spindles at the required angles relative to the tool-spindles. Indicator dials provided on the work-heads, as seen in Fig. 2, show the taper per inch in thousandths of an inch for which each head is positioned. The heads are swiveled by merely turning knobs on the end of screws. The pulley ends of the whorls are seated on tapered plugs inserted in the work-head spindles.

The holders for the boring tools are mounted on a bedplate fastened to the reciprocating table of

Fig. 2. The Two Work-heads of the Heald Bore-Matic Used for Boring Whorls can be Swiveled to Produce any Required Taper

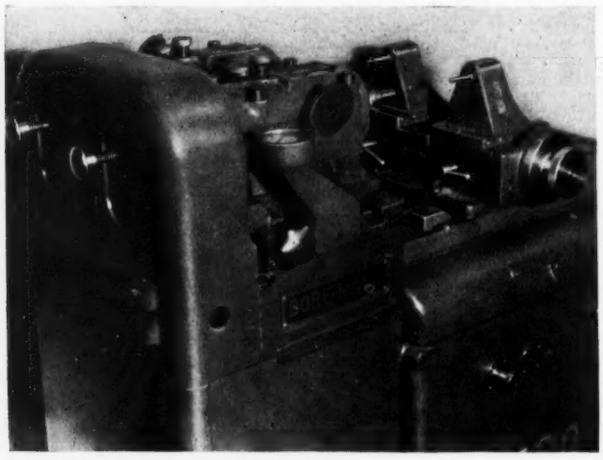
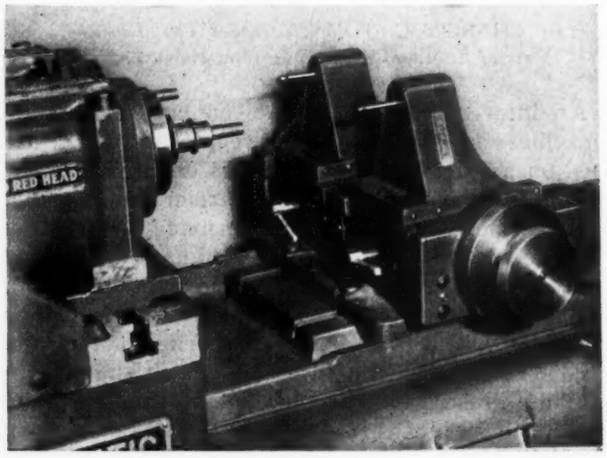


Fig. 3. Both Tool-holders are Adjustable Transversely for Taper-boring the Holes in the Whorls to Various Diameters



the machine. The tool-holders are adjustable transversely to permit boring to different diameters. This adjustment is accurately made by turning a knob equipped with a large graduated flange. After the tools have been accurately located, the tool-holders are locked in position by means of binder screws, which can be seen in Fig. 3 at the front of the bedplate on which the tool-holders are mounted. In the boring operation, the tools must, of course, enter the work-pieces for a considerable distance before they start cutting.

* * *

Recent Diesel Engine Developments

In a paper presented some time ago before the New England Section of the Society of Automotive Engineers, Myron S. Huckle reviewed the remarkable advance that has taken place in the use of Diesel engines, and expressed the belief that this type of power equipment has a tremendous future in almost every branch of industry and transportation. The development of these engines has made them suitable for locomotives, rail cars, submarines, and marine purposes in general. The weight of stationary and heavy marine engines has been reduced to a range of from 17 to 100 pounds per horsepower. The German "pocket" battleships are equipped with Diesel engines of 17 pounds per horsepower. The German Navy is said to have decided to stop the use of steam power entirely. The American Navy is also adopting Diesel engines on all ships for which suitable Diesel engines have been developed.

The Boston & Maine Railroad has ordered several Diesel locomotives for main-line service to pull regular coach trains. The adaptability of Diesel power for municipal power plants is demonstrated by the installation of five 7000-horsepower engines by the city of Vernon, Calif. The largest municipal Diesel power plant in the world is at Shanghai, China, where the Diesel horsepower has been increased from 37,500 to 51,000 horsepower. The application of Diesel power for all kinds of power-producing purposes is increasing much faster than the increase in steam turbine power. The application of steam power other than turbines is decreasing at a rapid rate.

It may be of interest to note the fundamental differences between the ordinary carburetor gasoline engine, operating on the Otto cycle, and the Diesel engine in which the non-volatile fuel oil is injected directly into the combustion chamber and ignited by the heat of the compression of the air charge. Take an ordinary magneto-ignition truck engine; replace the magneto by a small multi-cylinder fuel pump; run a high-pressure fuel line from each pump cylinder to a very small orifice in the wall of the corresponding combustion chamber; remove the carburetor, intake manifold, and ignition system; and put in high-compression pistons so that the compression pressure may be raised to about 500 pounds per square inch. The resulting engine would be a Diesel type and would run satisfactorily for a short time; but, for continual use, all structural parts would have to be strengthened and care taken to obtain better combustion conditions by a suitable modification of the combustion chamber.

Some designers believe that fuel injection is a great advantage, but think that compression ignition requires compression and combustion pressures too high for the most advantageous design. As a result, there has been a promising development of fuel injection engines with spark or arc ignition. It is claimed that though these spark- and arc-ignition engines do not have the high-compression pressures of the compression-ignition engines, they have almost as high an efficiency and will burn fuel oils that are difficult to ignite—oils that other types of engines cannot use at all.

* * *

Hot Bearings Caused by Unclean Containers

Hot bearings, in many instances, may be traced back to unclean oil containers by which the oil is transferred from the original barrels or drums. According to R. F. Lybeck of the Colonial Beacon Oil Co., Inc., writing in the October number of *Oil-Ways*, published by the Standard Oil Co. of New Jersey, lint from cotton waste used in cleaning containers sometimes gets into the oil, clogging the oil strainer and oil-feed line or reaching the bearing itself. This interferes with the proper oil flow and with the forming of the oil film on the bearing, resulting in overheating.

Endless trouble may occur from unclean grease. Grease may become dirty because the paddles or spoons used in taking it from containers are left exposed to the air, so that dirt collects on them. Grease barrels or drums should be kept closed and the spoons should be left inside. However, paddles should not be permitted to so stand in the grease that the container cover cannot be replaced. If an operator finds that dirty oil or grease is the cause of a hot bearing, he should obtain a sample and determine whether it contains the kind of dirt that might have collected in containers or spoons through careless handling.

When an operator uses drip oil, equal caution should be exercised against the invasion of dirt. A thing to be watched is illustrated by a recent case where the oil filter became clogged because drip from a leaky piston-rod was put back into the circulation system. In this instance, the operator did not know that the drip was compound steam cylinder oil, which also contained some condensed steam. When mixed with the oil in the circulating system, the dripping caused a sludge and the oil filter became clogged.

Selecting the Right Machine Tool for the Job

By WALTER K. BAILEY, Cleveland District Manager
The Warner & Swasey Co., Cleveland, Ohio

SELECTING the right machine tool for a job or for a number of jobs naturally involves a careful study of costs and productivity, but primarily, it involves a study of profit possibilities. Such studies, however, may be very misleading unless they are undertaken from the right point of view. The vital question is, "What machine will earn the most for the purchaser over a period of time?" In undertaking cost studies to answer this question, an incomplete point of view will obviously give an incorrect answer.

For instance, those who hold the purse strings of a company may be inclined to put too much emphasis on low initial machine cost, not giving enough attention to the element of low production or labor costs over a period of several years. Similarly, the shop superintendent, wishing to cooperate along economy lines, may be inclined simply to consider the question of whether the machine will do the work satisfactorily, without inquiring sufficiently as to how rapidly it will do the work and how speed will affect production costs and profit possibilities.

These attitudes represent an incomplete approach to the problem of intelligent machine tool buying; but when we attempt to determine what is the best method of approach, the problem is not so easy as it might seem.

The Proper Method of Approach is Not Always the One that Seems Most Obvious

The obvious method is to start with the cost of the machine, and to ascertain whether the purchase of such a machine would be profitable to the purchaser by determining how much that machine can produce and at what cost. Experience has shown, however, that the better method is to reverse this procedure—that is, to begin calculations on the basis of desired production, and to work forward to a determination of the type of machine tool that will accomplish this production with the most profit.

A customer in Ohio had developed a new product, experimentally, on a tool-room basis. It was decided to put the manufacture on a production basis. This involved the purchase of a turret lathe that would greatly reduce the former tool-room cost, and the Warner & Swasey Co. was asked to advise on the equipment that they considered was best fitted for this particular work.

It developed immediately that there were two types of turret lathes to be considered for the job, one of a newer type than the other. Both machines could produce the same quality of finished parts at tremendous savings over the present tool-room methods. The older type machine would cost about one-half as much as the newer one. However, the new machine was capable of greater production and, therefore, lower labor costs, because the work under consideration could use the many different speeds available on the new machine, which were not available on the older one. In other words, the maximum productive capacity of the new machine for this type of work was far greater than that of the old machine.

The Rate of Production Next Becomes the Important Factor

The next question to be considered was, "What rate of production is desired?" If comparatively small production were contemplated, the operating savings resulting from the high speeds possible on the newer type machine might not be sufficient to justify the increased cost of the more productive machine. Inquiry developed, however, that the eventual production rate contemplated was 600 units a month.

From this point on, it became a simple matter of arithmetic. Calculations showed that in order to produce 600 units a month, the older type machine would have to run 25 hours a day, whereas the newer type turret lathe, owing to its greater productive capacity for this type of work, could do the job on the basis of 12 machine-hours a day.

Applying labor costs to this differential, it developed that with the older machine, on a 600-unit monthly production basis, the company would pay out $1995 more a year in labor costs alone than with the newer type machine. This amount was greater than the difference in price between the older and the newer type lathe. The new type would, therefore, more than pay for its added cost within a year's time.

Naturally, the new type lathe was the one selected by the company because the dollars to be saved on labor cost alone would yield a dollar profit of $1995 per year, which amounted to 133 per cent gross profit on the additional cost of the new machine; or, expressing it another way, the additional

cost would be recovered in one year and there would be an extra profit of 33 per cent.

The Significant Factors that Determine the Solution of the Problem

The point is that the older type lathe, costing half as much, would have produced all of the desired parts as well as the newer type lathe, but it would have taken twice as long to do it; and the second point is that it would have been impossible to arrive at an accurate answer to this financial problem if the total production required had not been considered.

Note that this comparison has to do with the *added* profit possibility of the new machine, as compared with the older type, rather than with the profit possibilities of the new or old machine with the present production. In this case, the advantages of buying either one of these machines were self-evident, but if the first reaction to purchase the cheaper machine had been followed after an incomplete analysis, the purchaser would have lost the added profit possibilities that were obtainable by purchasing the higher priced and more efficient machine.

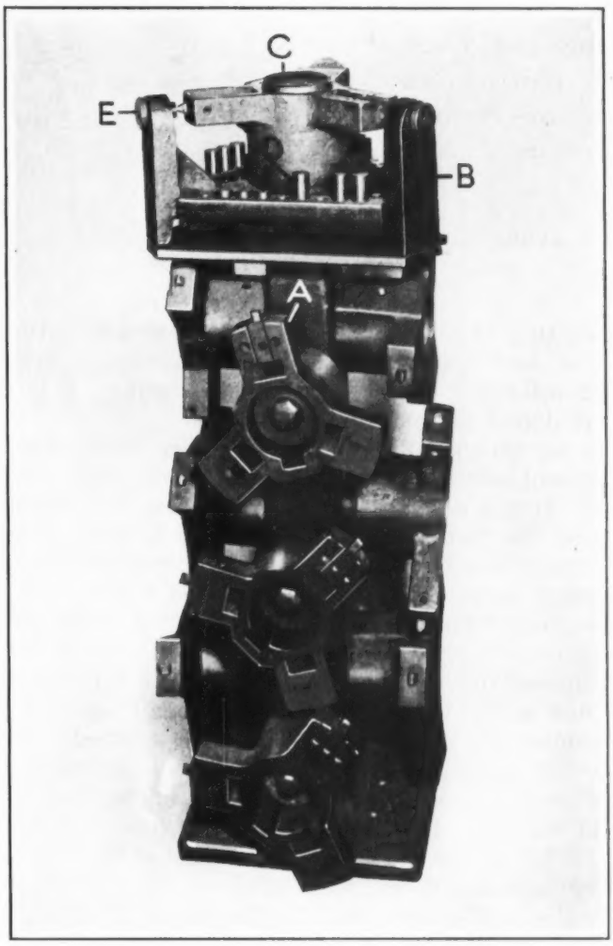
This illustration is of particular significance to many plants now operating old type machine tools which are still perfectly serviceable and still do well the work they are designed to do. Because they still operate satisfactorily, production men often assume that they represent proper operating efficiency, and are not in need of replacement. It is quite true that they may represent operating efficiency from the standpoint of workmanship, *but not from the standpoint of time.* From the latter point of view, they have become obsolete and under high production rate conditions should be replaced by machines of a newer type.

Contemplated rate of production is, therefore, an element of the utmost importance in determining machine tool efficiency and must be given first consideration in machine tool buying.

Stand for Setting and Storing Valve-Chamber Boring Heads

By OLIVER HERBERT

Tool-heads of the design seen at *A* in the illustration are used in the Grand Trunk Railway Shops at Battle Creek, Mich., for boring the valve chambers of locomotive cylinder castings. When not in use, these boring heads are stored in the tool-crib on the stand here illustrated. The four sides of this stand accommodate twelve heads at one time.



Handy Tool-crib Stand with Fixture for Setting the Cutters of Boring Heads

On top of the stand there is a fixture *B* which facilitates setting the three cutters of the boring heads to the correct radii. Two of the cutters are positioned for taking roughing cuts, and the third for taking a finishing cut. In setting the cutters, the boring head body is centered on a large accurate plug *C* at the center of the fixture. Plugs of the type seen at *D* are placed in bushings contained in the upright arms of the fixture.

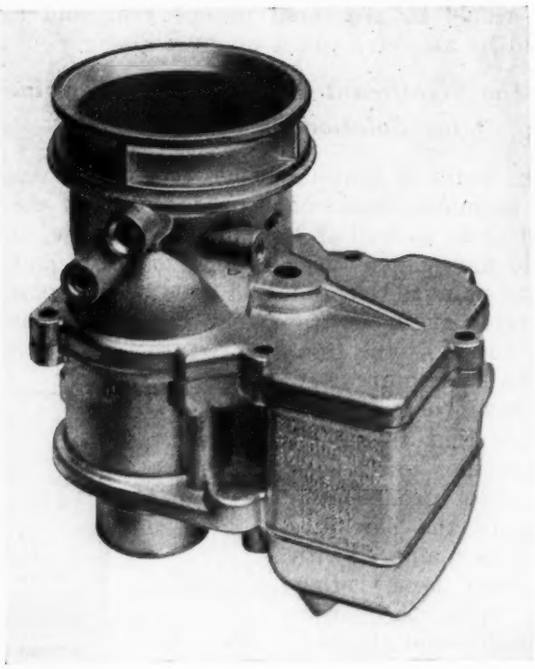
These plugs are ground to fit the bushings snugly and have a shoulder that seats against the front end of the bushings. A threaded shank provides for drawing this shoulder firmly against the bushing by tightening the corresponding nut *E*. The head of each plug beyond the shoulder is ground to a specified thickness. Different thicknesses obviously provide for setting the cutters of boring heads at different radii from the center of the heads.

After the boring head has been located on the fixture and the plugs have been inserted in the bushings, the cutters are adjusted radially until they just touch the plugs. They are then clamped.

* * *

The repair of gears of all sizes and shapes by the process known as bronze-welding is rapidly becoming quite general practice.

Die-Casting Dies that Achieve the Impossible



Construction of the Die Used to Produce the Air Horn of an Automobile Carburetor—Second of Two Articles

By CHARLES O. HERB

DIES employed for the casting of an automobile carburetor part of such an intricate design that even well informed engineers find it difficult to believe that it is a product of a steel mold were described in an article published in April MACHINERY. The present article is a continuation of the previous one. It will describe another set of dies, also made by the Madison-Kipp Corporation, Madison, Wis., for producing the air horn or upper body of the same carburetor. The details of this casting can be studied from Fig. 5. The die set for this part is also constructed with a movable member that opens up endwise relative to a stationary member and has slides that move sidewise on the movable member to permit the formation of ribs and under-cuts on the casting.

One of the interesting features of these dies is the use of a pin *A* on the stationary die (see Figs. 6 and 8) to operate sliding part *B* of the movable die. This part forms a flat surface and also cores a narrow slot in the wall of the carburetor that may be observed in the heading illustration. Part *B* must be moved vertically to permit ejecting the finished casting. It is attached to holder *C* for this purpose.

Pin *A* is mounted at an angle on the stationary die. Consequently, when the movable die is withdrawn from the stationary member, holder *C* is compelled to slide up along pin *A* and this moves part *B* vertically from the die cavity a distance of about 5/8 inch. Part *B* is dovetailed to block *D* to prevent it from falling off the face of the die and it is held in the raised position by spring detent *E*. Core *F* in the left-hand view of Fig. 8 produces a small hole at one side of the casting center. This core must also be withdrawn from the casting and it is mounted in part *B* for that purpose. One side of the boss that surrounds the hole produced by core *F* is formed by part *B*, while the remainder of the boss receives its shape from the left-hand slide of the movable die.

The inside of this carburetor casting is formed

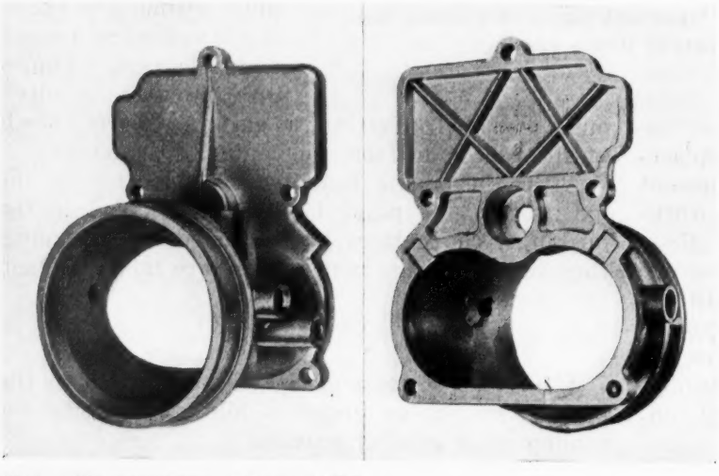


Fig. 5. Two Views of the Air Horn or Upper Body of an Automobile Carburetor Produced in the Dies Shown in Figs. 6 and 7

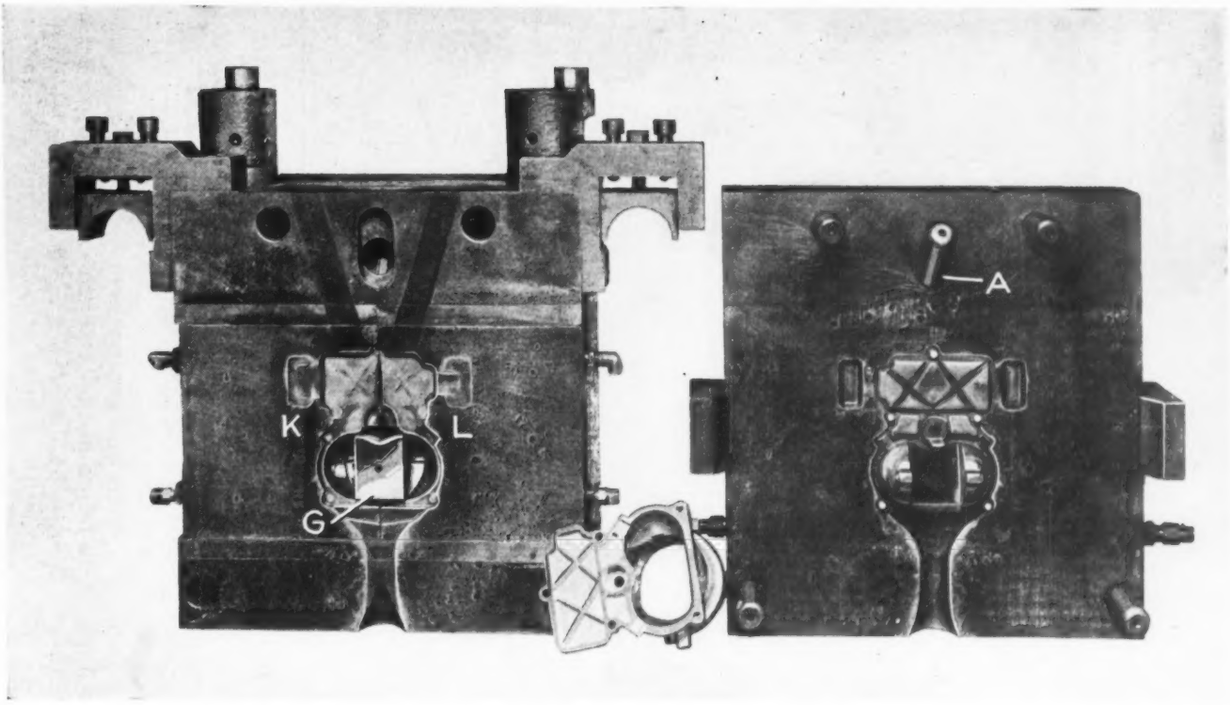
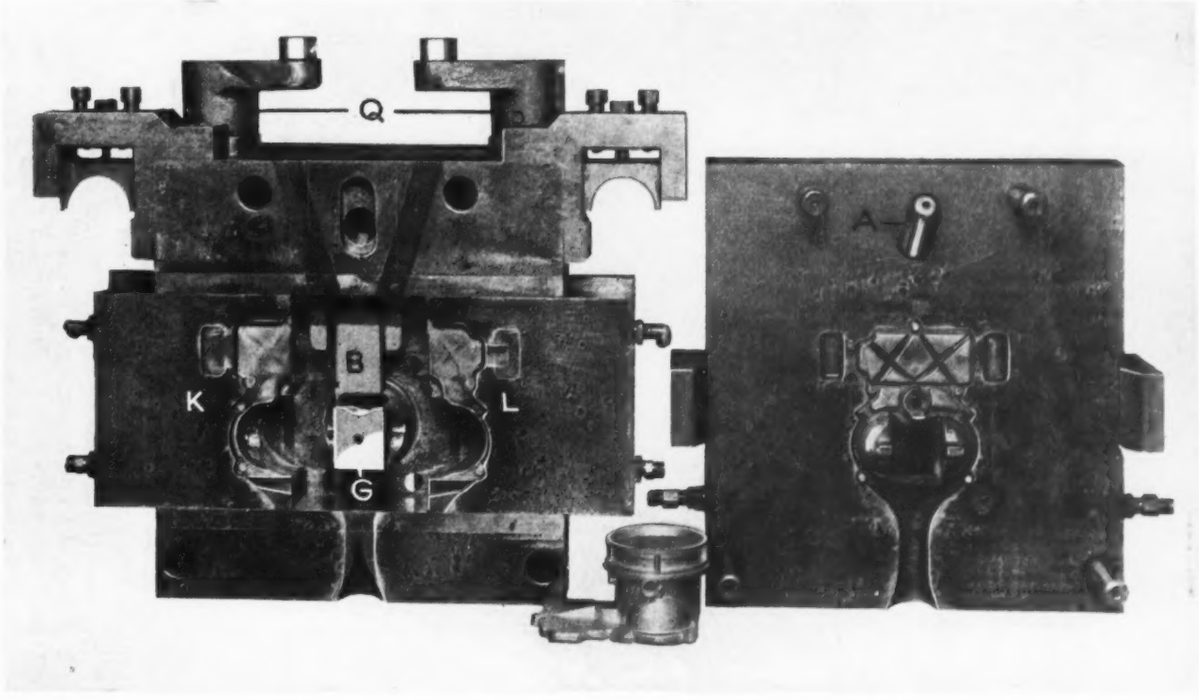


Fig. 6. Die Set Used for Producing the Carburetor Casting Shown in Fig. 5. Stationary Die Shown at Right, and Movable Die at Left in Closed Position

Fig. 7. Another View of Carburetor Air-horn Die-casting Dies which Shows the Various Sliding Members of the Movable Die in Open or Ejecting Position



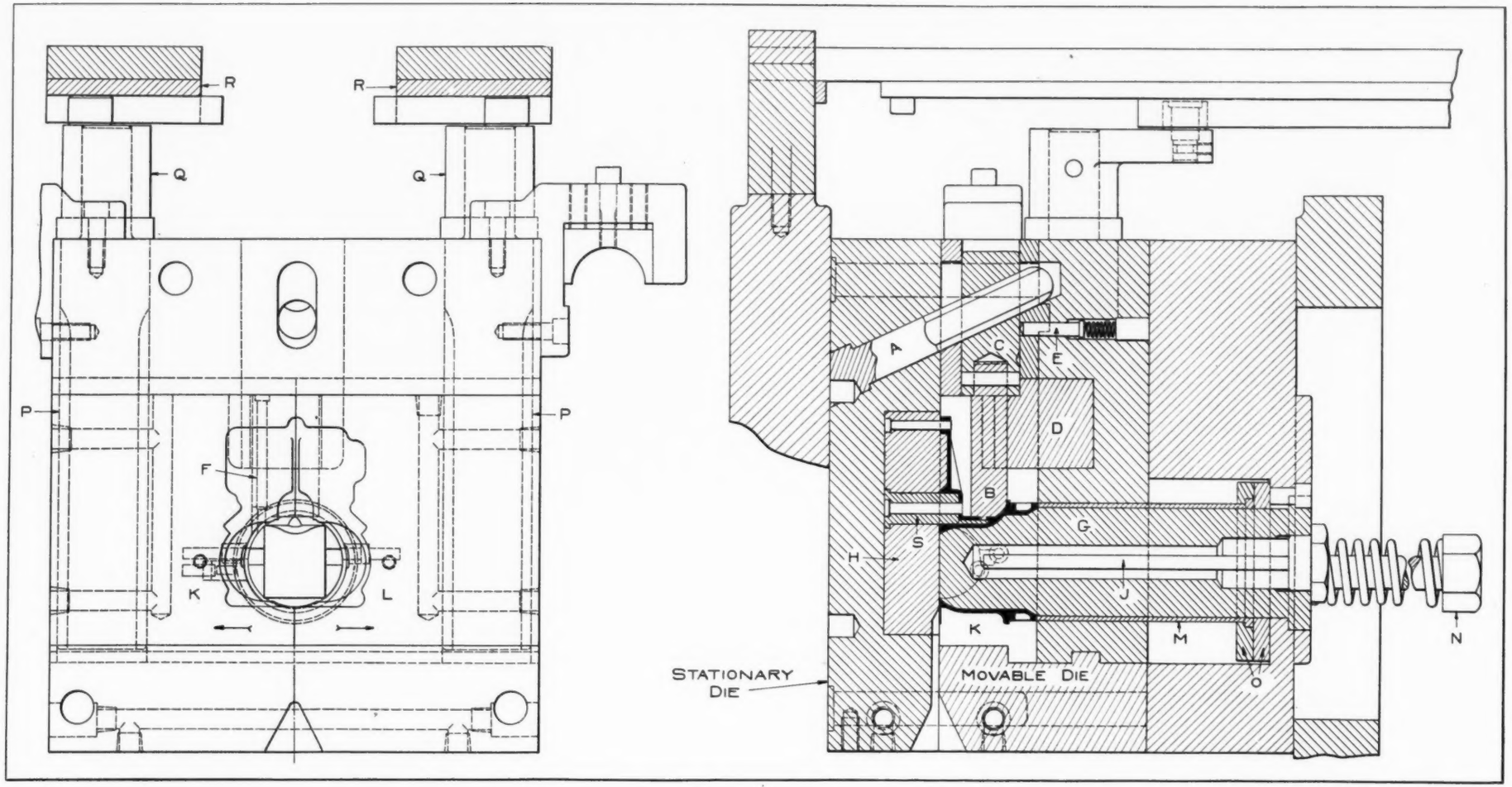


Fig. 8. Drawing Showing Method of Operating the Moving Members of the Die-casting Dies Shown in Figs. 6 and 7

by core *G* on the movable die, and block *H* on the stationary die. Block *H* is machined with two projections that fit closely over a square tongue on the end of core *G*. The construction of these two parts will be understood from the detailed drawings, Fig. 9.

Core *G* would become excessively hot and result in die-castings with blistered inside surfaces if provisions were not made to keep down its temperature. Therefore, the core was made with a quill *J*, Fig. 8, 5/16 inch outside diameter, which extends almost the full length of the core in a 3/4-inch hole. Water is forced continually through the quill and it returns from the die through the hole in which the quill is placed.

With this arrangement, core *G* is maintained at the same temperature as the other parts that form the die cavity. Water is also circulated across the bottom of both the movable and stationary dies in the vicinity of the sprue, as well

as in slides *K* and *L* of the movable die which form the sides of the casting.

An Ejector Sleeve Used Instead of Pins

Most automatic die-casting dies made by the Madison-Kipp Corporation are provided with long slender pins for ejecting the casting from the movable die. In the case of the dies here described, pins were not feasible. Ejection is accomplished by means of the long steel sleeve *M*, which also serves to close one end of the die cavity. When the movable die is withdrawn from the stationary member at the end of a casting operation, sleeve *M* is withdrawn with the other parts until the head of stud *N* strikes a stop on the machine. Then plates *O*, and, of course, sleeve *M* are prevented from moving farther, and as the movable die continues to the end of its stroke, the casting is forced from the cavity by sleeve *M*. The sleeve is returned to its normal position by the spring that surrounds stud *N* when the die is closed for the next operation.

The opening and closing of slides *K* and *L* are effected similarly to the movement of the slides on the die for the main carburetor body, which was described in April MACHINERY. In other words, slides *K* and *L* are operated sidewise by two pinion shafts *P*, which engage rack teeth cut in the back of the slides. At the upper end of each pinion shaft is mounted a crank-arm *Q*, which carries a roller that engages a cam groove in a bar *R* extending along the top of the machine. These pinion shafts are swiveled approximately 100 degrees as the rollers of the crank-arms follow the cam paths in bars *R*. Each slide is opened a distance of 1 1/2 inches.

Slides *K* and *L* are provided with several cores that produce holes horizontally in the casting. The slides are shaped to give the entire external contour of the casting, with the exception of the ends and the narrow surface that is formed by part *B*. Guide bars mounted on the stationary die insure proper closing of the slides for casting.

Attention is called to the long narrow slot that is formed by a slender projection on core *S*. This projection extends into the die cavity to form a hole that intersects the slot produced by core *B*. The projecting finger of core *S* is only 7/64 inch thick by 3/8 inch wide by 11/16 inch long. The stationary die member *H* is provided with six fixed cores for producing a similar number of holes, and in addition, this die member is shaped to produce the under side of the casting, as seen in the right-hand view of Fig. 5.

The gating provided for this set of dies can be observed in Figs. 6 and 7. At the point where the molten metal enters the die cavity, the gate is 1/32 inch deep and about 2 3/4 inches wide. About six "shots" can be made per minute with these dies. The castings are made of zinc. The dies will last for hundreds of thousands of castings.

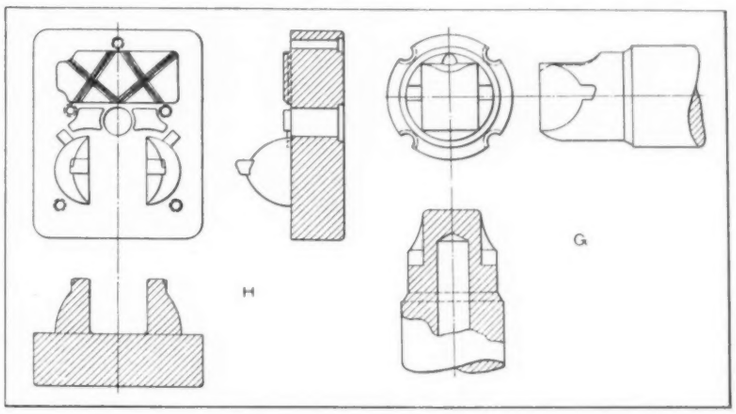


Fig. 9. Details of Die-block Insert H and Core G (See Fig. 8) which Form the Inside of the Carburetor Air-horn Die-casting

* * *

It is not possible to get something for nothing, and security (in the social sense) is not available for nothing. . . . The struggle for security made strong men of the pioneers. Will the gift of guaranteed security make strong men? Government gifts to the individual mean government control of the individual. If the individual is promised pay when unemployed, the government must, for its own protection, have something to say about how the individual is employed, and compel employment, if compulsion is necessary. Liberty and security cannot always be had at the same time. If the government promises security, it must exercise control, and one wonders what kind of government machine will be created for this purpose. . . . It is possible that the majority will be happier and better citizens if we continue our individual struggle for security.—*G. P. Torrence in the Link-Belt News.*

* * *

Ordinarily, one does not think of mixing machinery as equipment of the type that requires precision bearings. It is, therefore, of considerable interest to note that in the Lancaster mixers, made by the Lancaster Iron Works, Lancaster, Pa., Fafnir ball bearings are incorporated in varying sizes and designs. The smaller machines have from ten to twelve ball bearings each, while the largest unit has twenty-three — radial, angular-contact, thrust-washer, and wide inner-ring types.

EDITORIAL COMMENT

Because of the possibility of inflation and the probability of fluctuations in the purchasing power of the dollar, any method for insuring that a payment to be made in the future will represent the same purchasing power as it would today, is of the greatest importance to industry and business. Here is a plan that has actually been put into effect.

A Means to Control the Fluctuating Value of the Dollar

In the vicinity of New York, the owners of certain property made a lease for a number of years at a fixed rental, the lease containing an option to purchase the property at a given price. Let us say that this price was $1,000,000. The owners of the property, however, wanted to insure themselves against possible fluctuations in the value of the dollar. They wanted to make sure that five years from today, when the option might be exercised, the money paid would have the same purchasing power that $1,000,000 has today. Hence they introduced a "price index" clause in the contract.

They selected a recognized commodity price index representing the price of 784 commodities. The total of these prices was set at 100. Now, five years from today, if the lessee of the property wishes to exercise his option to purchase, this commodity price index of that time will be compared with the price index of today. This comparison will indicate whether or not there has been a rise or fall in the general range of prices.

If prices have gone up in 1940 and the commodity price index is 120 instead of 100, it will mean that the purchasing power of the dollar has decreased. The purchaser, therefore, if he wishes to exercise his option, will pay $1,000,000 plus 20 per cent, to make up for the difference in the purchasing power of the dollar. On the other hand, if the commodity index registers 80 in 1940, he would pay $1,000,000 less 20 per cent.

Commodity Price Index Furnishes a Measuring Rod Easy to Apply

Economists and business men alike have long felt that there was a need for some method of compensating for the fluctuating value of the dollar. Most proposals, however, have involved such legislative action as would modify the value of the dollar itself from time to time, to meet fluctuations in commodity prices. The price index method has the advantage that no legislation is required. Anyone can make it a part of a contract.

Such a clause should commend itself to the Government, since its object is to bring about much the same thing as the change in the gold standard was intended to accomplish—that is, to bring commodity values into a more equitable relation with dollar values. The plan outlined has the advantage of accomplishing definitely that which a change in the gold standard accomplishes only in an imperfect and uncertain manner.

By including a price index clause in contracts, business men will have less to fear in making future commitments. Many long-range enterprises are now delayed because industrial leaders fear possible changes in the value of the dollar, and hence hesitate to make long-range plans involving stipulated future payments. The general adoption of a price index clause would aid in stimulating business and would bring about the consummation of many projects that are now being delayed because capital hesitates to take a chance on the uncertainty of future prices.

Industry Can Write its Own Valuation Clause

The principle is applicable not only to long-term leases, mortgages, and bond issues, but can be applied advantageously to sales contracts involving future delivery. Those who were engaged in the machinery industry during the war know what happened then. Quotations were made for materials and machinery for future delivery, and when costs and wages rapidly rose, these quotations often caused heavy losses to the seller; in the deflation period beginning in 1920, many contracts—such as those for pig iron for future delivery—called for prices that were much greater than those in effect at the time of delivery. A price index clause would have prevented this; and if adopted now, would prevent similar difficulties in the future.

The operation of such a clause would discourage speculation and place business on a firmer foundation. It would be especially advantageous to the machinery and permanent goods industries, since these industries suffer most from the uncertainty as regards contracts and obligations to be fulfilled in the future.

Ingenious Mechanical Movements

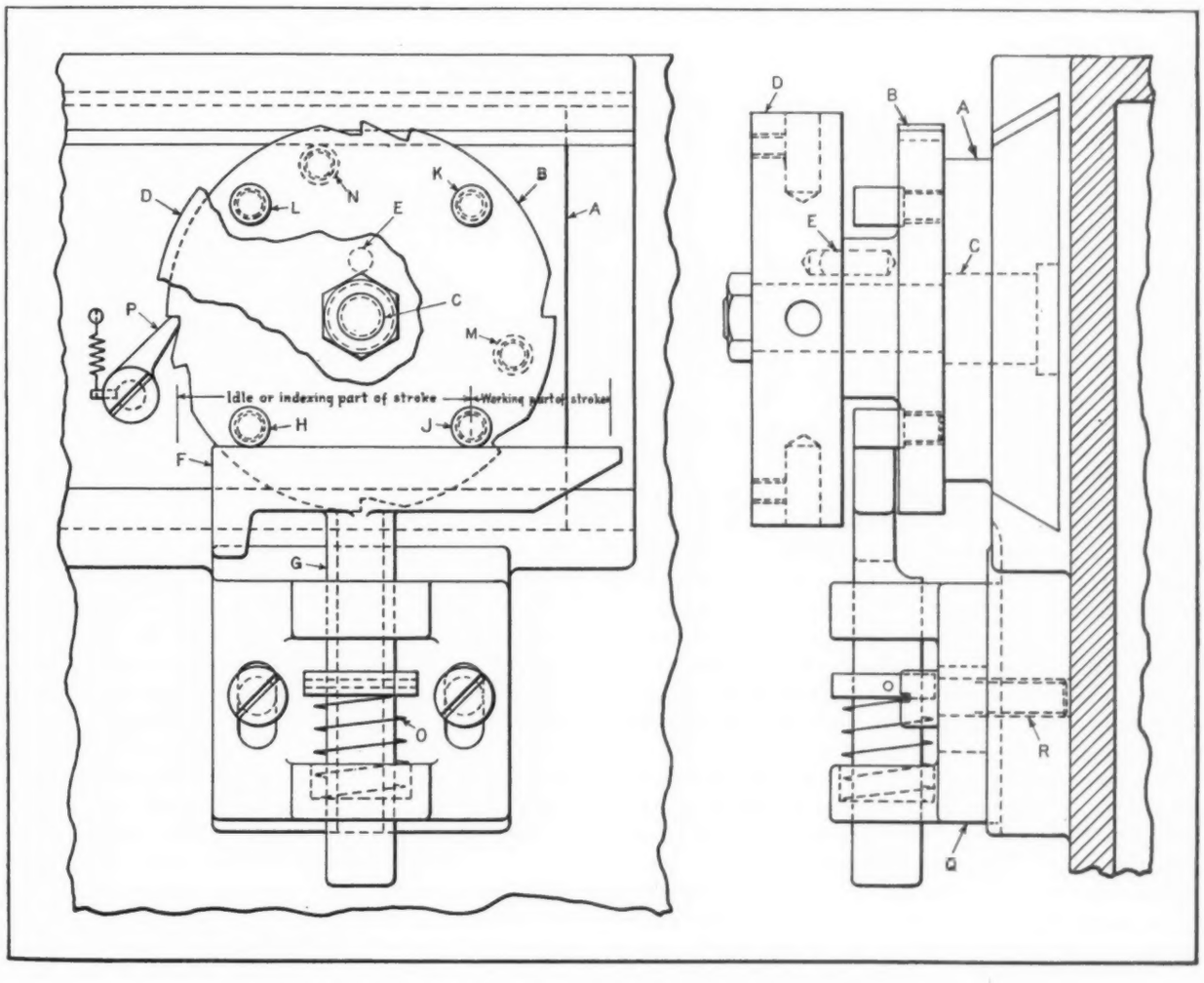
Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Indexing Mechanism with Interchangeable Turrets for Either Three or Four Stations

By JOSEPH E. FENNO

A reciprocating slide on an automatic machine designed for drilling and counterboring small fiber parts is provided with two turrets which are interchangeable. One turret has three equally spaced tool stations, while the other has four stations. The one with three stations is used for work on which three different tools are required. The three-station dial is replaced by the four-station dial when the work requires the use of four different tools. By the elimination of the extra indexing movement through the use of the three-station turret whenever possible, an appreciable saving is realized.

Referring to the accompanying illustration, the tool-slide is shown at *A*. Upon the slide is mounted the permanent indexing dial *B* which is free to turn on the stud *C* fixed in the slide. The four-station turret *D* is shown mounted on the dial. The pin *E*, which is a drive fit in the dial and a slip fit in the turret, prevents the turret from rotating on the dial. The turret is indexed by means of the blade *F*, which is integral with the spring-actuated

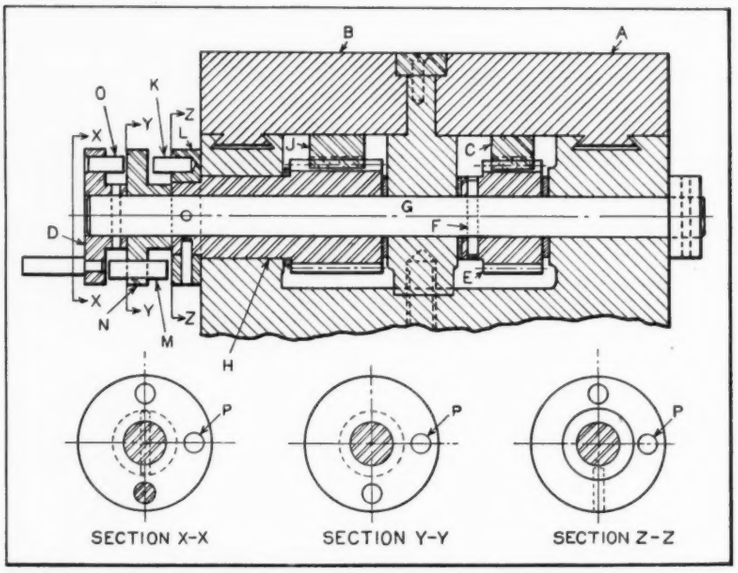


Mechanism for Indexing Turret to Either Three or Four Stations

plunger *G*, the blade engaging the pins *H*, *J*, *K*, and *L* in the dial.

It will be noted that the four pins *H*, *J*, *K*, and *L* are in equally spaced holes in the dial, which correspond with the four turret stations. When this turret is replaced by the three-station turret (not shown), only three pins are used in the dial. In that case, two pins are located at *M* and *N*, pin *H* remaining in the position shown. The indexing of the turret is accomplished during the idle part of the stroke indicated.

In the position shown, the slide, moving toward the right, is approaching the working part of its stroke. On continuing this movement, the tool opposite the work performs its operation, after which the slide starts on its return stroke. As pin *H* leaves the heel of blade *F* on its movement to the left, the dial is prevented from reversing its movement by the pawl *P* pivoted to the slide. This pawl engages teeth cut in the periphery of the dial. Incidentally, without this ratchet arrangement, the reversal of the dial would prevent the engagement of the blade with the succeeding pin, thus preventing the indexing of the dial. After pin *J* has left blade *F*, the latter is forced forward by spring *O*, a distance equal to about three-quarters the diameter of the pin.



Mechanism that Enables Slides A and B to be Moved in Either Direction by Turning Handwheel D, Slide B Always Dwelling for a Certain Period During the Initial Movement of Slide A

Now, when the slide reverses its movement, pin *J* comes in contact with the left-hand end of blade *F*, so that further movement of the slide will cause the blade to rotate the turret. Continued rotation of the turret results in pin *K* coming in contact with the blade; and as the slide continues, the blade is pushed outward, so that pins *J* and *K* become located in contact with the long edge of blade *F*. The tool in the second turret station is now in position for performing its operation.

No means other than blade *F* are provided for locking the turret. The tool pins, pressing against the blade *F* as shown, serve to prevent the turret from rotating. This arrangement has been found entirely satisfactory for the class of work handled on the machine on which it is used. When the three-station turret is employed, it is necessary to move the bracket *Q* inward, so that the heel of blade *F* on plunger *G* will pass the horizontal center line of the right-hand pin when the slide is moved to its extreme left-hand position. To make this adjustment, it is only necessary to loosen the screws *R* which lock the bracket in place.

Delayed-Movement Mechanism for Machine Slide

By JOHN A. HONEGGER

The mechanism shown in the accompanying illustration was designed recently by the writer for the purpose of producing a dwell or delay in the movement of slide *B* while slide *A* enters upon the first portion of its cycle. On the return stroke, slide *B* dwells in the same manner while slide *A* begins its movement back to its original position.

This requires a delay arrangement that will operate at each end of the cycle, so that the first slide will remain stationary in each position for a given length of time. The dwells could, of course, be obtained by means of cams. However, the mechanism shown is simple and more compact than a cam arrangement. In this mechanism, disks *N* and *D*, with their contacting pins, are arranged similarly to the tumblers employed on a combination lock. Referring to the illustration, the slide *A* moves a given distance at the start before slide *B* moves in the same direction. At the end of the stroke, slide *A* moves in the reverse direction the same distance as at the start before slide *B* begins its return movement.

These motions are obtained in the following manner: Slide *A*, through rack *C*, is connected directly to the disk or handwheel *D* by gear *E*, pin *F*, and shaft *G*. Shaft *G*, however, is allowed to rotate freely in the combination gear and bushing *H*. Gear-bushing *H* is connected to handwheel *D* through pin *K* in collar *L* which comes into contact with pin *M* in the free-running collar *N*. The opposite end of pin *M* comes into contact with pin *O* in handwheel *D*. Thus pin *O* makes one revolution minus an amount equal to the thickness of the pin before it comes in contact with pin *M*. The opposite

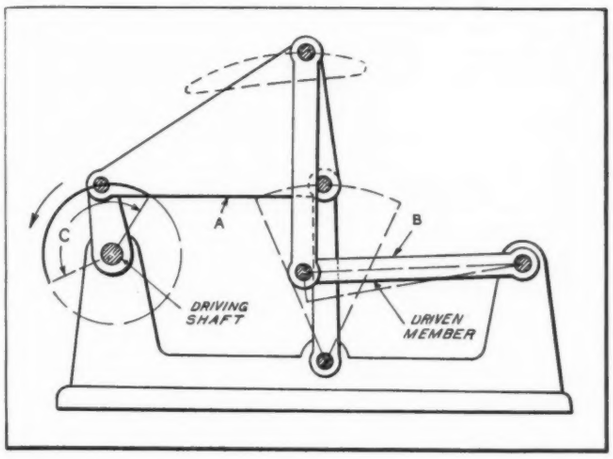


Fig. 1. Mechanism that Allows the Driven Member B to Remain in Position Shown while Crankpin of Driving Arm Passes through Arc C

end of pin *M* can then make one revolution less the thickness of the pin before coming in contact with pin *K* which moves gear-bushing *H*, causing slide *B* to move. On the return stroke, the reverse action takes place.

This means that two revolutions of disk *D*, less the thickness of two pins, can be obtained before slide *B* follows the movement of slide *A*. Less than this amount of movement can be obtained by placing two pins in each of the three disks at such angular positions as to give the required movements. Thus, in the case shown, the total movement of *A* in advance of *B* is 1 1/4 revolutions minus the thickness of three pins if pins *P* are inserted. This movement lends itself very readily to operations that require the withdrawal of a certain tool from the work before the entire carriage is withdrawn.

Mechanism for Obtaining Dwell in Lever Movement

By PAUL GRODZINSKI

In September, 1934, MACHINERY, page 21, were shown link mechanisms which allowed the driven members to dwell for relatively long intervals. Figs. 1 and 2 of the present article illustrate further developments in the application of link mechanisms for this purpose. In the case of the mechanism shown in Fig. 1, any point in the flat triangular plate which constitutes the rod *A* can be used for a link connection. For the designing of such mechanisms, it is necessary to study the different forms of curves described by the various points on rod *A*. The forms of the curves traced by the different points on this rod vary distinctly according to their relative positions.

To obtain long dwell periods, only the curves that have large circular sections on a part of their outline are used. Geometrical methods have been evolved to determine such curves, but they are rather complicated. However, some very remarkable improvements in dwell movements have been made by applying such formulas.

There are curves that show a near relationship to circular forms and there are others in which the radii of curvature will increase to such an extent that the curves practically resemble a straight line. Mechanisms with dwells can be designed, in which the driven member connected with the base of the mechanism has a sliding way, such as shown at *W*, Fig. 2. A member with two vertical slideways at 90 degrees or any other angle can be used in place of the swinging lever.

* * *

Canadian Machine Tool Demand

There has been a material improvement in the demand for machine tools in Canada during recent months. The improvement is most evident in the automotive and electrical industries, but steel mills and agricultural equipment manufacturers have also made fair purchases. The trend has favored American-made machine tools on account of quick deliveries. The favorable exchange rate has also been a factor in the increased business with the United States. Plant equipment changes for new model cars have raised purchases of machine tools by automotive factories to the highest level since 1930. Most of this business has gone to the United States, according to Damon C. Woods, American Consul at Toronto, Canada. *(Based on information given out by the Machinery Division, Department of Commerce)*

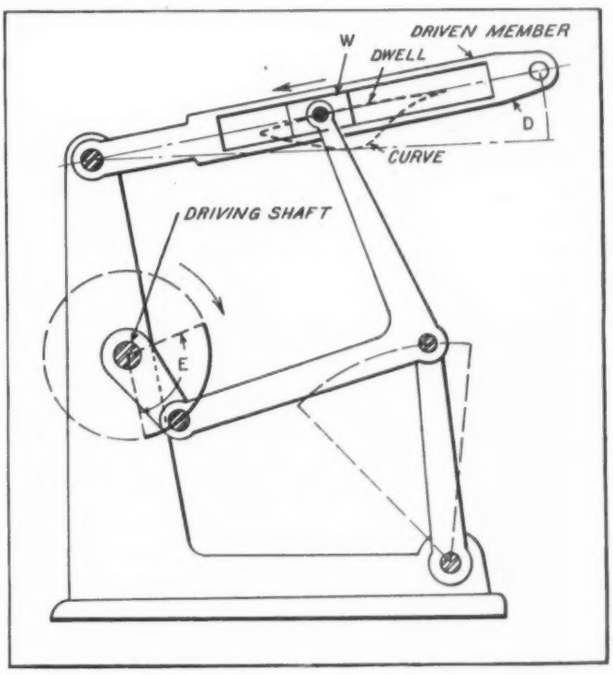


Fig. 2. The Driven Member D Remains in the Position Shown while the Crankpin of the Driving Arm Passes through Arc E

Engineering News Flashes

The World Over

A Sun-Driven Electric Motor

Sufficient electric energy to operate a miniature electric motor can be obtained directly from sunlight with a new photo-electric cell, far more sensitive than the usual ones of its type. The new cell has been produced by the General Electric Research Laboratory at Schenectady, N. Y. Even the light from an incandescent lamp falling on such cells is sufficient to operate a small motor.

In the experiments conducted, four cells are used, connected together, to operate a motor rated at four ten-millionths of a horsepower. Enough light energy is converted into electricity when a 75-watt incandescent lamp is lighted at a distance of 8 inches from the cells to cause the motor, which uses three ten-thousandths of an ampere of current, to revolve at a fair speed. Direct sunlight revolves the motor at about 400 revolutions per minute. The motor, which is direct-connected to the cells, is of special construction, with jewel bearings and other features to reduce frictional losses to a minimum. There are, as yet, no practical applications for this sun-driven motor, because of its extremely limited power.

Soviet Russia Claims Largest Welded Bridge

According to information published in the *Economic Review of the Soviet Union*, the largest welded bridge in the world has recently been opened at Stalinsk, where it spans the Avushka River. The bridge is approximately 285 feet long and 60 feet wide.

A 183,333-Kva. Turbine Generator

A generator is now being built by the Westinghouse Electric & Mfg. Co., for the latest addition to the Richmond Station of the Philadelphia Electric Co., which is one of the largest single electrical machines ever built. It involves many new developments necessitated by its size. This generator is rated at 183,333 Kva. Ten years ago a generator of this size would have been considered impossible, and the construction of this unit illustrates the advances that have been made in the design and construction of large units during the past decade.

It is of interest to note that this machine will be installed in a building designed ten years ago to house four 50,000-Kw. units, but will occupy no more than the space originally laid out for one of those units. The generator stator weighs 225 tons, and the rotor 125 tons. The construction of the rotor presented the greatest problem in design, as will be understood when it is noted that a mass of this size rotates at 1800 revolutions per minute.

Glass of Unusual Strength

Glass thirteen times as resistant to breakage as that manufactured by the accepted methods has been developed in the laboratory, according to Arthur D. Little, Inc., industrial chemists. It is produced by reversing a practice of long standing —that is, instead of annealing the glass—cooling it slowly from the molten state to prevent setting up harmful stresses—it is chilled quickly from a temperature of approximately 1500 degrees F., either by a jet of air or by immersion in oil at about 400 degrees F. The new material is not laminated nor reinforced in any way to give it such exceptional strength. It is said to break into small pieces, with rounded and therefore less harmful edges, and to be clear enough for optical use.

New Electroplating Process

A new electroplating process for tableware is being used in Sheffield, England, according to the *London Times Trade and Engineering Supplement.* The articles are plated with rhodium, a metal in the platinum group. This metal produces a silvery-white surface which is untarnishable and requires no cleaning. It is said that articles so plated can scarcely be distinguished from silver; but, being extremely hard, the plate wears well and does not show scratches.

Testing Motors for High Altitudes

A "high-altitude" testing room for aviation motors has been installed at the Fiat factory in Turin, Italy. The equipment enables motors to be tested under conditions similar to those encountered in flights at altitudes up to 14,000 meters (about 46,000 feet).

Long Life of Alloy Steel Dies

The long life of alloy steels when used for dies is well illustrated by the following experience: Using a molybdenum die steel for blanking tin-plate can ends, it was found possible to blank 3,500,000 ends between regrindings; and, in all, 35,000,000 can ends were blanked with a single die. The composition of the die steel was as follows: Chromium, 12.5 per cent; molybdenum, 0.80 to 1.00 per cent; vanadium, 1.00 per cent; and carbon, 1.60 per cent.

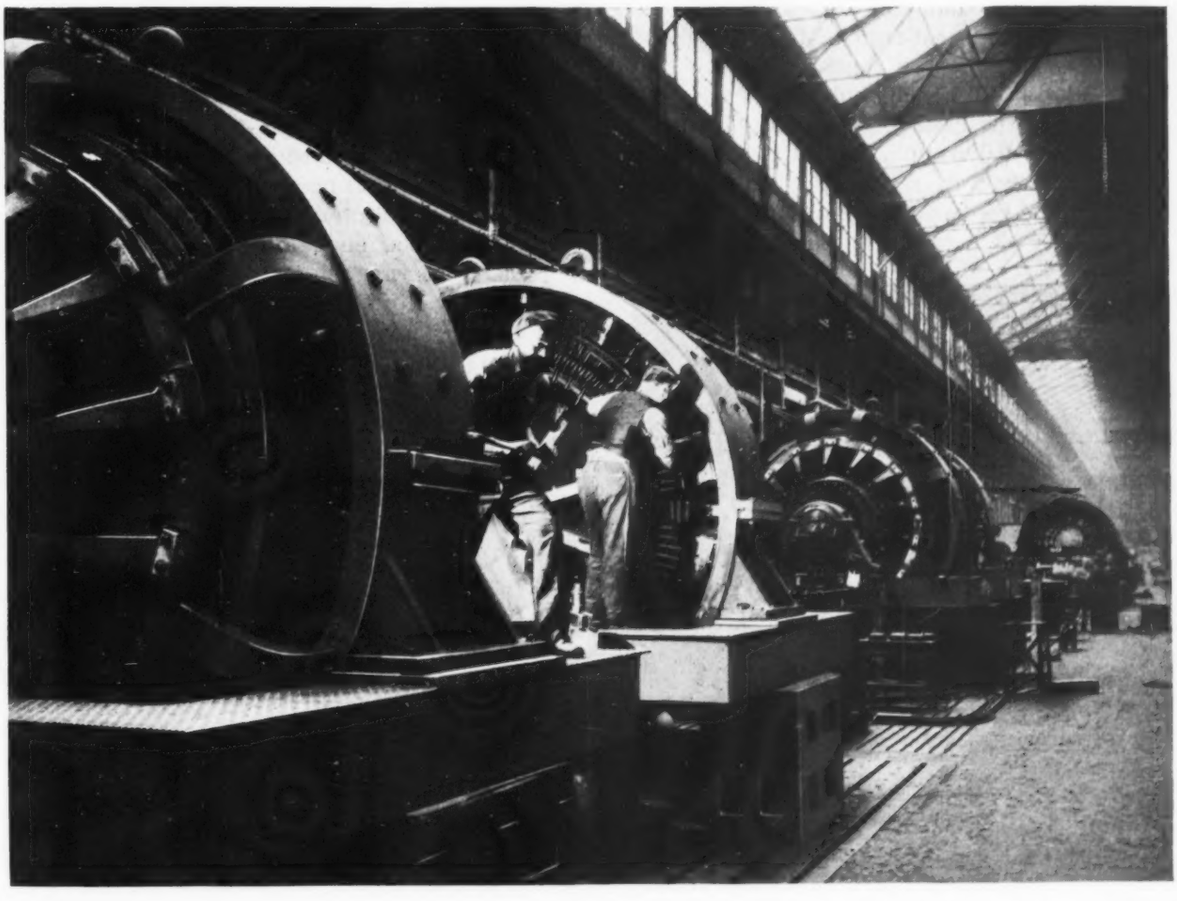
German Railroads Build High-Speed Locomotives

Higher speeds on railroads seems to be the order of the day throughout the world. The German State Railways are turning to steam power for higher speeds. Several locomotives have been ordered whose regular speed will exceed 100 miles an hour. The Borsig plant near Berlin is now constructing two streamline express locomotives, shaped somewhat like a bullet, capable of pulling five cars with 300 passengers at a speed of 110 miles an hour. The same company is developing an engine to burn pulverized coal, automatically fed into the combustion chamber. These engines will have the engineer's cab at the front. Other German firms are working on similar locomotives designed to pull trains at speeds up to 110 miles an hour.

Gyroplanes to be Built in Scotland

Plans are being made for the building at Perth, Scotland, of a plant for constructing airplanes of the gyroplane type, known as the Kay Gyroplane. The chief feature of this type is the control of the lifting power by "variable incidence of the rotor blades." The particular novelty is in the rotor hub assembly, which aids in getting the machine quickly off the ground. The plane is an all-metal single seater with a 75-horsepower engine.

Assembling 3000-horsepower Steel-mill Motors in the East Pittsburgh Shops of the Westinghouse Electric & Mfg. Co. for the Ford New 56-inch Hot-strip Mill in Detroit. These Five Motors are Capable of a Combined Power Output Greater than that of 3000 Ford V-eights.



Diamond Boring of Automobile Pistons

The Machining of Pistons to Tool-Room Accuracy, with Special Reference to Limited Production Schedules

By C. A. BIRKEBAK, Engineer
Ex-Cell-O Aircraft & Tool Corporation
Detroit, Mich.

IN the April number of MACHINERY, the turning and boring of automobile pistons on a mass-production basis were illustrated and described. The present article deals with boring methods for more limited production schedules. A machine arranged for the rough- and finish-boring of pistons ranging from 2 1/2 to 4 1/2 inches in diameter, with piston-pin holes from 1/2 inch to 1 3/4 inches in diameter, is shown in Fig. 1. Both aluminum and cast-iron pistons are finished in this machine. On both types, the depth of the roughing cut is 1/32 inch, but the depth of the finishing cut in the case of the aluminum pistons is from 0.004 to 0.005 inch, while the depth of cut in finishing the cast-iron pistons is from 0.004 to 0.006 inch. The feed is 0.005 inch in rough-boring both metals, but a feed of 0.003 inch is employed in finishing the cast-iron pistons, and a feed of only 0.0015 inch in finishing the aluminum pistons. Diamond tools are employed on the aluminum pistons and tungsten-carbide tools on the cast-iron pistons. Thirty-six cast-iron pistons, 4 1/2 inches in diameter, with 1 inch piston-pin holes, are produced per hour and forty-five aluminum pistons, at an efficiency of 80 per cent.

On account of the comparatively small output required, a single piston is machined at a time. As will be clear from Fig. 1, the closed end of the piston is seated on a spring-backed center with the dome against a hardened and ground swivel plate *A*. The open or skirt end is held in position by a tapered adapter *B*, which fits the chamfer of the open piston end. Locating fingers *C* are inserted in the rough piston-pin holes to bring them into proper alignment for boring. These fingers are operated by turning a handwheel on the overhead housing. After the piston has been located, it is clamped by means of a jig lock, actuated through crank-lever *D*, which brings the adapter firmly against the piston skirt. The locating fingers are then raised to their original position, where they are held during the operation by spring tension.

The work-fixture is first fed toward the left-hand spindle for rough-boring both piston-pin holes, after which the movement of the hydraulic table is automatically reversed and the piston is carried to the right-hand spindle for finishing both holes.

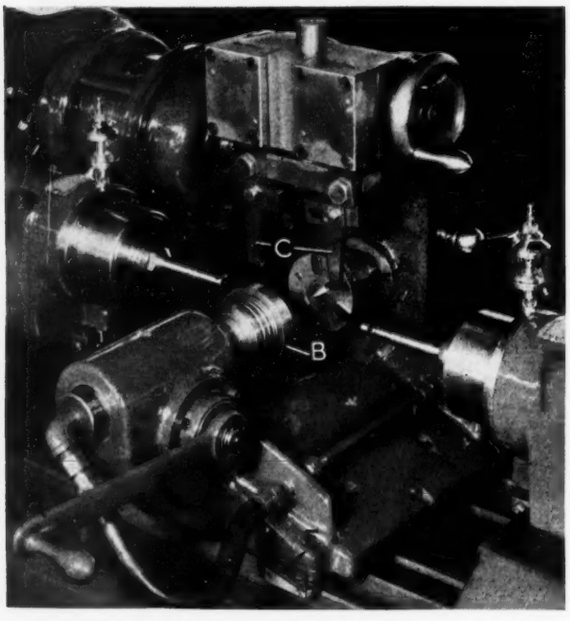


Fig. 1. Equipment that is Adjustable to Meet a Wide Range of Conditions in Boring Piston-pin Holes

The fixture is then returned to the middle of the machine, where it is stopped for reloading.

Provision was made to accommodate a range of pistons with this tooling. For instance, there is a hand micrometer screw at the back of the fixture which permits of changing the distance between the center line of the tool-spindles and the spring-backed center that supports the closed end of the piston. Graduations are provided for setting this adjustable center.

To accommodate pistons where the piston-pin holes are off center, either up or down, as the piston is located in the machine, the fixture has been mounted on angular surfaces on a sub-base. The vertical position of the fixture on the angular surfaces, and thus the height of the piston center line with respect to the tool-spindles, can be adjusted by means of a screw. Graduations at *E* indicate the vertical setting of the fixtures. A guard covers the control dogs on the front of the fixture table, as well as the plungers on top of the hydraulic unit. The two boring units are driven by individual motors.

Other Set-Ups for Limited Production

The heading illustration shows a machine built for the rough- and finish-boring of pistons intended for replacement purposes. Both aluminum and cast-iron pistons from 3 to 4 inches in diameter are accommodated. The finishing cut is taken at a depth of 0.005 inch on both the aluminum and cast-iron pistons, but the total depth of stock removed in the roughing and finishing cuts is 1/32 inch for the aluminum pistons and 1/64 inch for the cast-iron pistons. In machining the aluminum pistons, the tool-spindles rotate at 3500 revolutions per minute, while in machining the cast-iron pistons, the speed is 1530 revolutions per minute. With the aluminum pistons, the feed is 0.0015 inch and with the cast-iron pistons, 0.002 inch. Seventy-five aluminum pistons and forty-nine cast-iron pistons are bored per hour, at an efficiency of 80 per cent.

The pistons are placed in the fixture with the skirt resting over a tapered spring yielding member and against a stationary locator, and they are held in position by means of a swivel clamp and a spring center locator. The swivel clamp is operated by a standard jig-lock handle. The piston is then aligned by means of a plunger operated by a handwheel.

The fixture has three stations—one for loading, one for rough-boring, and one for finish-boring. It is indexed by means of the lever at the lower front of the fixture. Rough- and finish-boring operations are performed simultaneously on two pistons by the tools of two boring spindle units mounted on the bridge at the left-hand end of the machine. At the same time, the operator reloads the third fixture station so that there is no idle time.

Tractor pistons 1.250 inches in diameter, made of cast iron, are finish-bored at the rate of thirty-five per hour with the equipment shown in Fig. 2, while pistons 1.750 inches in diameter are bored at the rate of twenty-one per hour with the same equipment, the production in both cases being based again on an efficiency of 80 per cent. The depth of cut for both pistons is from 0.005 to 0.006 inch, and the feed, 0.002 inch.

The skirt end of the piston is seated over an interchangeable locator plate, and center *A* on the upper arm of the fixture is lowered until it engages the center hole in the closed face of the piston. The piston is then aligned for boring by means of two adjustable cam-operated fingers *B* which enter the piston-pin holes from each side. These fingers are operated by handwheel *C*. After the piston has been lined up, a steel point at the lower end of rod *D* is lowered into contact with the closed face of the piston to prevent the piston from creeping during the operation. The piston is then locked by tightening center *A*, after which fingers *B* are removed and the piston is ready for the finish-boring. The operation is performed as the work-table is fed to the spindle unit on the bridge at the left-hand end of the machine. Two extra locator plates are seen at the right-hand end of the table.

The examples of precision turning and boring illustrated and described in this article and in the article on page 468 of April MACHINERY indicate the possibilities of the equipment and the methods now available for application in industry. While the examples shown are from automobile plants, there are numerous operations of similar character in many branches of the machine-building field.

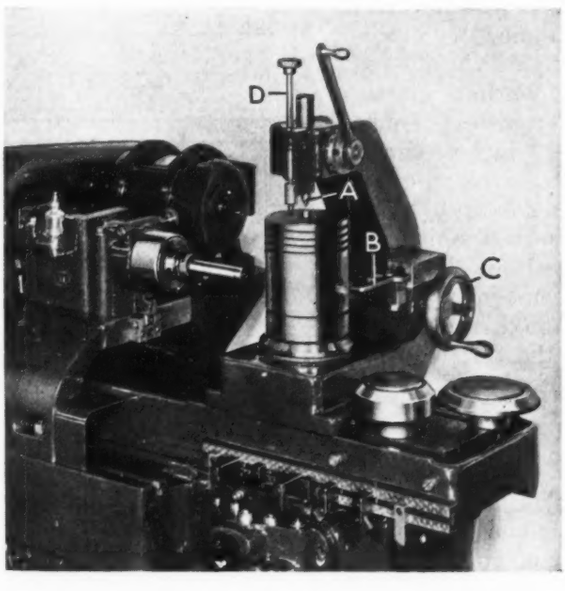


Fig. 2. Machine that Handles Tractor Pistons of Different Diameters, Required in Limited Quantities

Quantity Production of Steel Type by Rolling

By C. W. HINMAN

The facility with which steel or other materials can be knurled in a lathe, either in straight, angular, or diamond patterns, with a pair of knurling wheels set in a toolpost has led to several other applications of the same principle. Knurling causes metal displacements by forcing the material into plastic flow. Thread-rolling is fundamentally a similar operation. A knurling wheel made with sharp teeth having the same shape and lead as the thread desired, but of the opposite hand, is called "a threading roll."

Knurling wheels revolving parallel to the travel of a horizontal reciprocating table are used for embossing flat work. From the face of such a knurling wheel, complicated designs that have been properly engraved can be rolled in steel. This practice suggested a method for the quantity production of steel type such as is used in machines that print through an inked ribbon. Concavities in the knurling face will produce a corresponding raised area on the work, and vice versa. The male and female type used for embossing zinc alloy addressing plates is made in this manner.

Steel type for typewriting machines is usually made from a female master plate about fifty times the size desired. This master plate is hardened, and then used in connection with a pantograph engraving machine. A follower is made to travel within the contour of the master form, by which the movements of a very delicate engraving cutter are controlled. The cutter routs a corresponding matrix in steel, reduced to full size. These matrices are hardened and polished, and are the embossing characters used for rolling large quantities of the finished male type from steel.

A special machine is employed for rolling the characters. It has a horizontal reciprocating table that carries the work in a fixture. The fixture usually has twelve separate parallel slots holding forty-two blanks each, which is the same as the number of type used in a standard keyboard. There are suitable separators for holding the blanks which are inserted between them. It is better to roll the characters in rows containing equal faces, as this gives an even distribution of the rolling pressure.

The cylindrical roller above the work is between 6 and 7 inches in diameter. It carries twelve annular parallel slots filled with the embossing matrices, forty-two in each slot, like an inserted-tooth milling cutter. These matrices are equally spaced to match the twelve rows of equally spaced blanks during the rolling interval. The work travel is mechanically synchronized with the roller revolutions.

The embossing roller is automatically fed deeper before each horizontal travel begins. In starting the operation, the feed is obviously the greatest, but toward the finish of the work, an advance of less than 0.0005 inch is made for each pass. The feed depends on the size of the characters rolled. The characters have a sufficient side draft, both internally and externally, to provide clearance in the rolling operation. It is apparent that this cold-rolling operation forces the metal into plastic flow, the same as when knurling, while the side draft along the face lines causes the metal to fill up between the interstices of the type lines, forming a printing face as perfect as its matrix. The type faces become work-hardened, of course, but are relieved when casehardened.

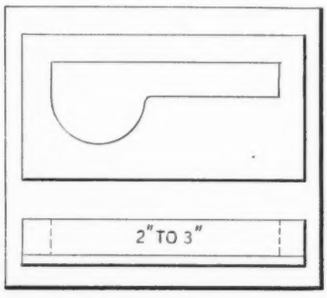
This method is applicable to the manufacture of many small simple parts when no coining press is available. If several different parts of steel, such as are used in small locks, clocks, adding machines, etc., are to be made, a matrix for each piece is spaced around the circumference of a cylinder. The raised portions, bosses, steps, stops, and stamping are then rolled in. The long-wearing qualities of a better work-hardened piece is thus obtained without the fractures and crystallization often found in coined work. This experience in rolling steel type indicates that the knurling principle is useful in many other ways besides the making of knurled-head thumb-screws.

* * *

A Handy Micrometer "Board"

By EMIL A. SCHIGUT

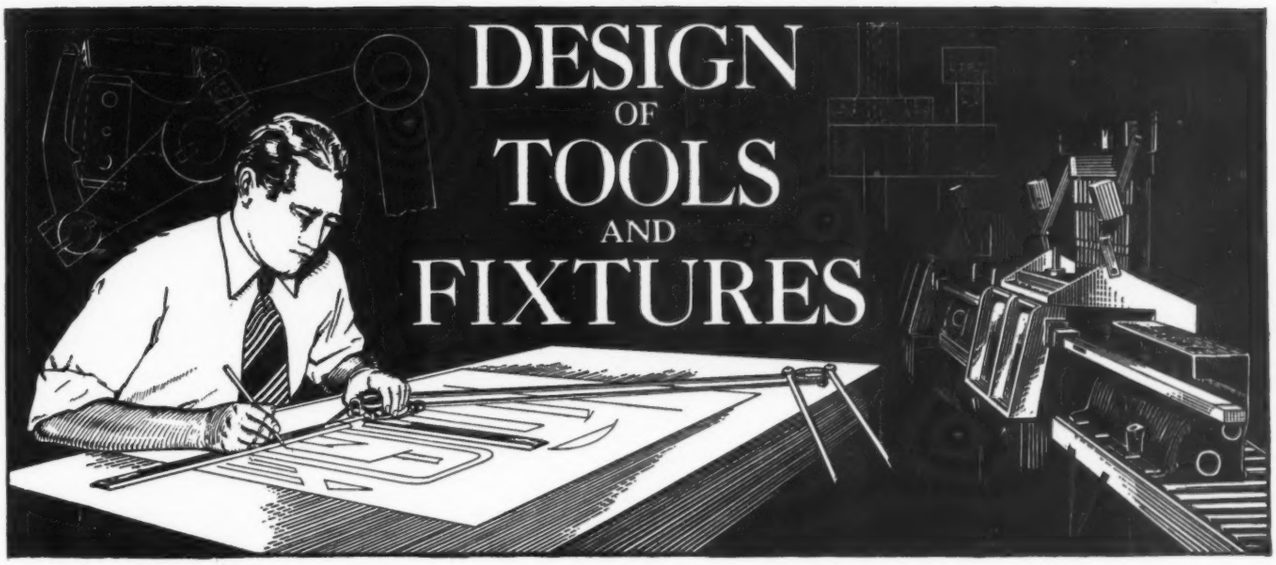
A very good way to keep micrometers in good shape, both in the tool-crib and in the shop, is to provide each one with a micrometer "board," like the one shown in the illustration. These boards are made in two pieces as shown. The top piece is cut out of 7/8-inch pine to fit the various sizes of micrometers from 1 to 12 inches, and the bottom piece can be made of 3/16-inch ply-wood nailed and glued on. The whole assembly may be painted, and the size of the micrometer held by each board should be marked on the side.



Holder that Provides Safe Place to Lay Micrometer in Shop and Saves Space in the Tool-crib

* * *

The use of nickel alloy steels in the making of tools and dies for various purposes will be the subject of an article in June MACHINERY.



Press Tools for Making Ferrules

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

Ferrules of brass, with flanges and cylinder walls highly finished, the inside and outside diameters to size, the flange diameter and over-all height to given specifications, plus temper imparted by work hardening, can be made with dies of the design shown in the accompanying illustrations. The finish-forming die, Fig. 1, should be made with the outer punch *A* ground 0.001 inch smaller than the finished rim diameter of the ferrule *F*. The finish-forming die should be about 0.0005 inch smaller, and the outside diameter of the forming punch *C* 0.0005 inch larger, than the finish dimensions of the ferrule. The working surfaces of the punch and die should be highly polished and should show a hardness of at least 63 on the Rockwell C scale.

Trial blanks should be made of stock from 10 to 25 per cent thicker than the thickness of the flange and wall required, according to the number of passes necessary to produce the size and hardness of wall desired. The diameter of the blank, thickness of stock, and size of pierced hole must be found by

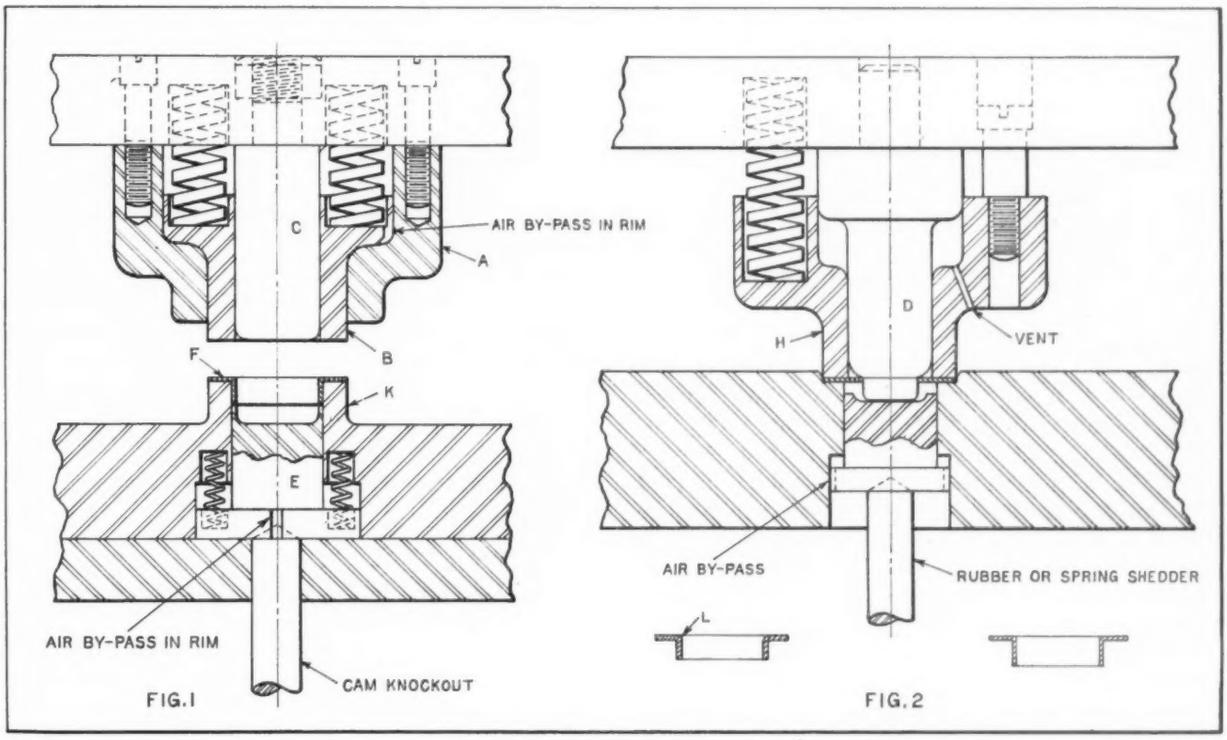
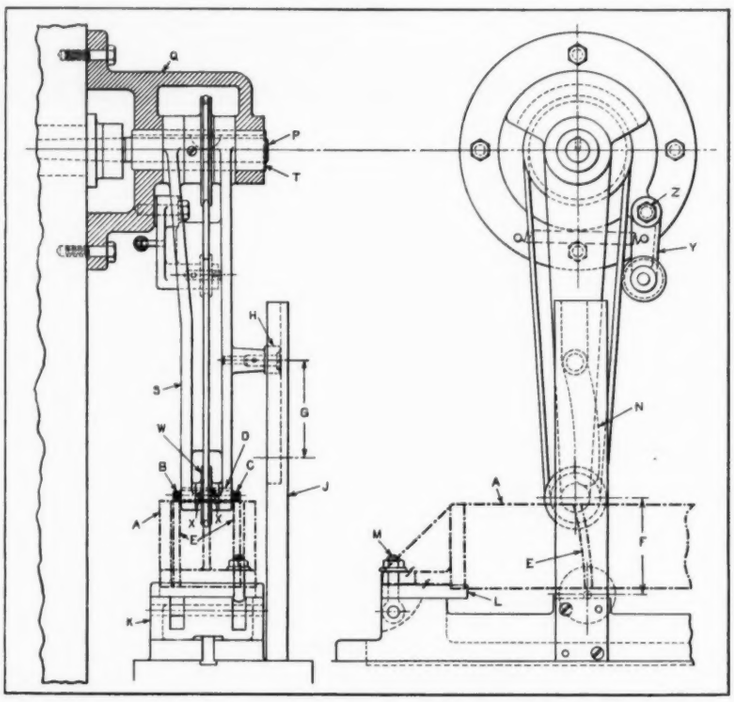


Fig. 1. Finish-forming Die for Flanged Ferrules. Fig. 2. Punch and Die for First Forming Operation on Ferrules

trial. The rim diameter of the blank should be slightly smaller than the bore in the outer shell *A*. The skirt of the formed shell shown in Fig. 1 should be slightly shorter than the distance between the top of the shedder and the face of the swaging diering shown in Fig. 2. The reason for making the rim smaller and the skirt shorter is to provide space into which the metal can be squeezed when planishing the flange down to a given thickness. Thus, the metal on striking punch *A*, Fig. 1, flows toward punch *C*, filling out the corner *L*, Fig. 2, which may be brought up sharp if necessary.

As the punches in Fig. 1 descend, the punch *B* makes contact with the rim of the ferrule. Upon further downward movement of the punches, punch *B* recedes and punch *C* starts to iron out the bore of the work. Now, before punch *C* has completed its ironing operation, punch *A* slips over the die horn *K*, enclosing the rim of the blank. Thus, punch *A* holds the rim of the ferrule to size while punch *B* applies force to the rim face and comes to rest against the back of the plate. This force causes the metal to flow and thin out the rim. The ironing of the skirt causes the metal to flow downward, lengthening it. When the metal makes contact with the knock-out, it will even the edge and square it up. Excess metal will be pinched off as punch *C* passes beyond the inner edge of knock-out *E*.



Milling Machine Attachment for Machining Curved Grooves

Great care must be exercised in finding the blank diameter, and the stock thickness must be carefully checked to see that it does not vary from a given thickness, for if it does, ferrules with long or short skirts will result. It may be necessary to squeeze the skirt material more than once to harden it. If this has to be done, and the size can be increased without harm, another die about 0.002 inch larger than the first and a larger diameter punch will be necessary for the operation. After piercing and blanking, the work should be annealed to soften the cut edges. The work is next covered with a thin coating of pure lard oil, applied hot, by dipping the work, which is spread on wire mesh trays to allow the excess oil to run back into the oil tanks.

The blanks are formed by placing them, one at a time, in the nest of the first forming die, Fig. 2, the punch hold-down *H* gripping the rim while the forcing punch *D* opens the pierced hole, rolling out the metal to the wall of the die. This leaves the outer end of the skirt thinner than the stock near the flange, due to the stretching that takes place in opening the hole out to a larger diameter.

If the skirt is made too long in relation to the pierced hole in the blank, the edge of the skirt will crack. In the case of soft brass, it is a good rule never to try to open a pierced hole more than one-third its original size. The skirt will be lengthened to some extent by ironing from the inside. If much ironing must be done, or many passes made, the stock should be annealed after every second pass, as it becomes very hard and brittle.

In making tools for this type of forming, the finishing die and punch are always the larger tools of the set, because the outside diameter of the blank must slip into the next operation die, each subsequent punch being made a little larger to iron the stock, to reduce wall thickness and to insure the correct wall size the whole length of the skirt.

In using finishing dies of this kind, the press must be equipped with a cam type knock-out to insure kicking the blank out of the die and to allow the knock-out shedder to fall back to its lowest position to receive the next blank. To obtain the best results, all ironing and planishing dies should be used in knuckle presses of adequate capacity.

Attachment with Swinging Arm and Master Plate for Milling Curved Grooves

By F. SERVER

The attachment shown in the accompanying illustration was designed for simultaneously machining the two curved grooves *E* within the rectangular-shaped housing *A*. The curved grooves are milled by cutters *B* and *C*, held in a sleeve *D*, by means of which they are revolved as a unit. Grooves of ir-

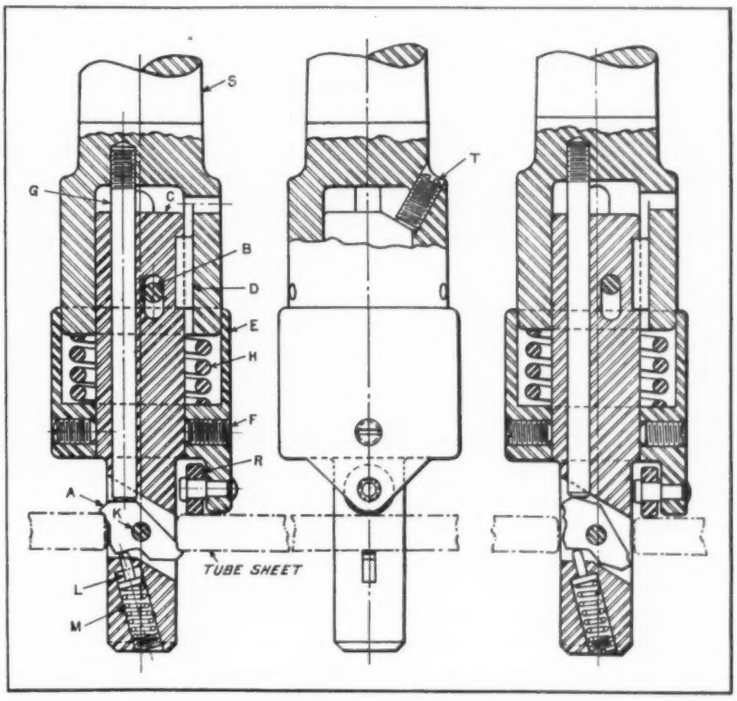
regular cam shape can also be machined by simply providing a guiding cam on master plate *J* with a guiding slot *N* of the required shape.

In milling the grooves, the vertical feed of the milling machine is used, which causes the cutters to travel upward a distance *F* equal to the traverse *G* of the cam-roll *H*. The work is located both sidewise and lengthwise by two plates *L*. Two eyebolts *M* swing upward into slots in the work, as shown in the view to the right, for clamping it in place. The surfaces on the work previously finished are indicated by the small finish marks.

The cam-plate *J* with the curved groove *N*, shaped to generate the milled groove *E*, is attached to base *K* of the fixture. The fact that roll *H* is nearer the pivoting point of the swinging arm than the cutters must be taken into consideration in laying out the groove *N*. The milling attachment itself is supported by a bracket *Q*, attached to the milling machine frame. Arbor *P* fits the machine spindle and serves to revolve the sleeve *T* which is keyed to it. Sleeve *T* carries a driving pulley for a round belt, which drives the small pulley *W* for revolving the cutters. The cutters are necessarily made right- and left-hand and are held in place by separate screws *X*, so that they can be set out the correct amount for milling the grooves.

A unit consisting of an arm *Y* and a small roll serves to keep the belt tight by means of a spring under tension, the arm *Y* being free to pivot on stud *Z*. The rocker arm *S* is free to pivot on sleeve *T* at the upper end. Thus, as the table of the milling machine is fed upward for a distance equal to *F*, the swinging of arm *S* while under the control of cam groove *N* will cause the cutters to mill the curved grooves *E*.

The cam-plate *J* is lengthened out beyond the milling length at its upper end, so that the table of the machine can be dropped sufficiently to allow a new piece of work to be put in place without having the roll *H* leave the cam slot. The lower edge of pulley *W* must, of course, clear the top surface of the work to permit the work to be removed from the fixture.



Tool Used for Rounding Sharp Edges of Holes Drilled in Steel Plate

Tool for Removing Sharp Edges of Holes Bored in Tubesheet

By JOSEPH WAITKUS, Wellsville, N. Y.

The tool shown in the accompanying illustration was designed for removing the sharp edges of holes bored in a tubesheet. As several thousand holes were to be machined, the tool was designed to withstand long and continuous service. Its particular advantage lies in the type of cutter used. The cutter *A* can be easily removed and sharpened when necessary. Furthermore, the size of the radius formed on the work can be varied between wide limits by having a series of cutters for one tool-holder. Heat-treating is confined entirely to the cutters.

It is not necessary to enter into a lengthy description of the tool. The tapered shank *S* fits into the ordinary socket of a drill press. The shank is fitted with a pin *B* which passes through a slot provided in the cutter-holder *C*. The cutter-holder is restricted to vertical motion by the key *D* and the pin *B*. The shank extension *E* is fastened to the cutter-holder by two set-screws *F*.

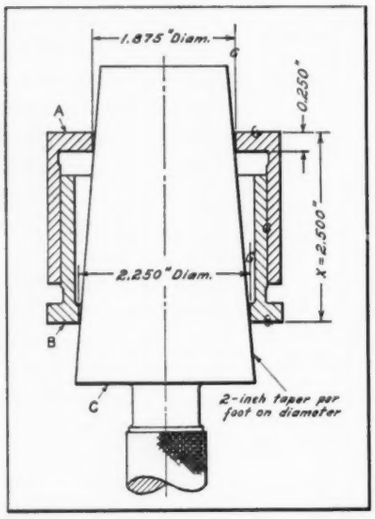
A rod *G* fastened in shank *S* passes through a hole in the cutter-holder and down to the slot where cutter *A* is pivoted on the pin *K*. A pin *L* serves to raise the cutter to the neutral position when the rod recedes, as indicated in the view to the right. A roller *R* is provided to permit easier rotation of the tool as pressure is applied. The spring *H* serves to raise rod *G* as the pressure is relieved.

The operation is simple. As pressure is applied through the shank of the tool, spring *H* is compressed and rod *G* forces the cutter down into the position indicated in the view to the left. A light pressure is all that is necessary for this operation. When the pressure is relieved, spring *M* causes pin *L* to raise the cutter to the idle position. After a few trials, the set-screw *T* is set so as to limit the amount that the shank can be forced down against spring *H*. This adjustment, in turn, determines the depth of the cut or amount of metal removed from the edges of the holes in the tubesheet.

Gage for Testing Taper of Plug Gages and Reamers

By C. W. PUTNAM, Athol, Mass.

A gage consisting of two hardened and ground bushings *A* and *B*, assembled as shown in the accompanying illustration, is suggested by the writer as a quick and accurate means for testing the taper per foot on taper plug gages and taper reamers. As far as the writer knows, a gage of this kind has never been made commercially. The illustration shows a gage designed to test a plug gage having a taper of 2 inches per foot on the diameter. The bushing *A* is ground for a slip fit over bushing *B* and is provided with a hole 1.875 inches in diameter. The hole in bushing *B* is ground to a diameter of 2.250 inches.



Method of Testing Taper of Plug Gage

In testing a taper, the two bushings are placed over the work and allowed to come in contact with the taper as shown, care being taken to lower the bushings gently into position to avoid unnecessary wear of the contacting edges. After the bushings are in the position shown, a 3-inch micrometer is used to measure the dimension *X* over the two bushings. If the taper plug *C* is ground accurately to a taper of 2 inches per foot, the micrometer reading will be exactly 2.500 inches.

This device can be used for other tapers within its range of adjustment. Other bushings could easily be made for larger or smaller tapers. The rules for making the calculations required in designing or using taper gages of this kind may be found in MACHINERY'S HANDBOOK.

Toolmakers' Universal Drill Jig

By PETER L. BUDWITZ, Meriden, Conn.

A device that is universal in its application, relative to drilling or boring accurately spaced holes in various forms of tool work, is shown in the accompanying illustration. It consists of a set of bushings used as drill guides, a pair of parallels for clamping the bushings, and knurled clamping screws and nuts.

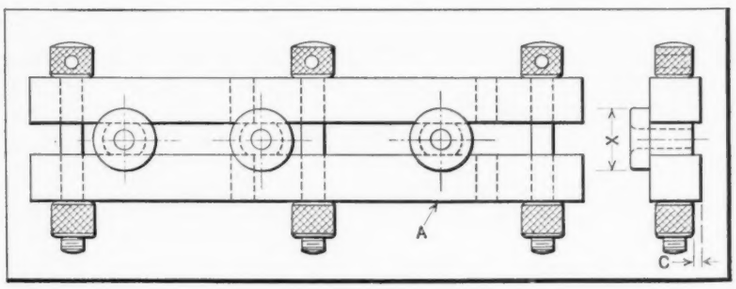
Having a piece of work in which holes are to be bored accurately, the user sets the drill bushings with the customary measuring instruments, utilizing the heads of the bushings, which are all machined to the same diameter *X*, as measuring points. To aid in setting the bushings, the parallels are tightened up with just enough pressure to permit the bushings to be moved by tapping them lightly. When properly set, they can be clamped more securely. The device can then be clamped on the work to be drilled.

Should the number of holes to be drilled in the same line be greater than the number of bushings in the device, a fastening clamp should be applied to parallel *A*, thus holding it in a fixed position after it has been properly located. After the first set of holes has been bored, a plug can be inserted through one of the bushings and the free parallel loosened enough to permit the other bushings to be set for the remaining holes, locating them from the plugged bushing. Since parallel *A* is fixed, it is obvious that all holes bored will be accurately in line with each other.

Should it be required to drill holes at an angle from previously bored holes, a plug can be inserted through one of the bushings and work, and the device swung around to any desired position, using the plugged point as the vertex, and suitable means for obtaining the required angular setting of the parallels.

Both parallels of the device are hardened and ground accurately. The bushings are made with two flat sides which facilitate clamping. To make the calculations for hole spacing easy, the diameter *X* on the bushings should be of a size that can be easily divided. There should be ample clearance *C* under the clamp screw heads and nuts to permit using a square or protractor blade in lining up the parallels.

The holes in the bushings can be made of a convenient size, since the work piece to be drilled can be bored to any size desired, utilizing counterbores with proper leaders. Extra holes are drilled in the parallels for the clamp screws, so that they can be shifted, in cases where they interfere with bushing locations.



Toolmakers' Drill Jig Consisting of Parallels, Clamping Bolts, and Drill Bushings that can be Adjusted to Any Desired Spacing

Cutting Rotors from 12-Inch Steel Plate with Oxy-Acetylene

THE rapidity and accuracy with which heavy machine parts can be cut to shape from steel plate by the use of oxy-acetylene cutting equipment was demonstrated recently by a large steel company in cutting blanks for two rotors from slabs of steel 12 inches in thickness with Linde Air Products Co.'s equipment. Each rotor was to be 4 feet 8 3/4 inches in diameter and was made in halves.

The first slab was 7 by 7 1/2 feet and weighed 26,400 pounds, while the second and larger slab weighed about 28,200 pounds. As each rotor was designed to be made in two parts, the slabs were first reduced to a more workable size by cutting them in half. For severing these slabs, the shape-cutting machine was adjusted to cut at the rate of 3 inches per minute, using an oxy-acetylene pressure of about 130 pounds per square inch. The kerf for these cuts was found to be 1/4 inch wide. This width of cut was noted by the templet-maker, in making the necessary allowance on the templets.

While the templets were being made, the first slab was set in position for the shape-cutting operation. Since, in addition to the peripheral cutting, it was necessary to make three triangular openings in each blank, starting places for the cuts for these openings were made with an oxygen lance. The spots lanced were preheated with a cutting blowpipe. Only about twenty-two seconds was required to lance each hole. A few trial cuts were then made at the edge of the slab, in order to determine the exact cutting speed and oxygen pressure required. A speed of 3 1/4 inches per minute and an oxygen pressure of about 110 pounds per square inch were found best. The three openings between the spokes were then cut, making the outside of the rotor the last part to be finished.

Each section of the rotor was completed in twelve man-hours. The sections were found to be remarkably accurate, the faces of the outside cuts, as well as those between the spokes, being square with the top and bottom faces of the section. The weights of the four different segments were found to agree within 34 pounds.

* * *

Industrial Accidents in 1934

According to W. H. Cameron, managing director of the National Safety Council, there was an increase of 7 per cent in the occupational fatalities in 1934, when 15,500 workers lost their lives, about 1000 more than in 1933. The greatest burden of accident prevention, however, must not be assumed to belong to industry. Figures gathered by many plants during recent years indicate that many more employes are injured off duty than during working hours. The Western Electric Co., for example, during a four-year period, lost only two employes through accidents while they were at work, whereas thirty-five lost their lives outside of working hours.

Fig. 1. Cutting Accurately Shaped Rotor Segments from 12-inch Steel Plate

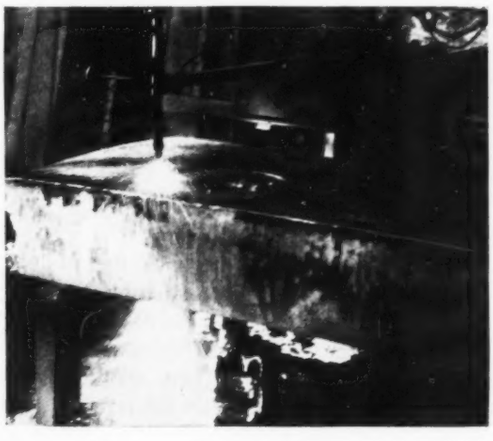
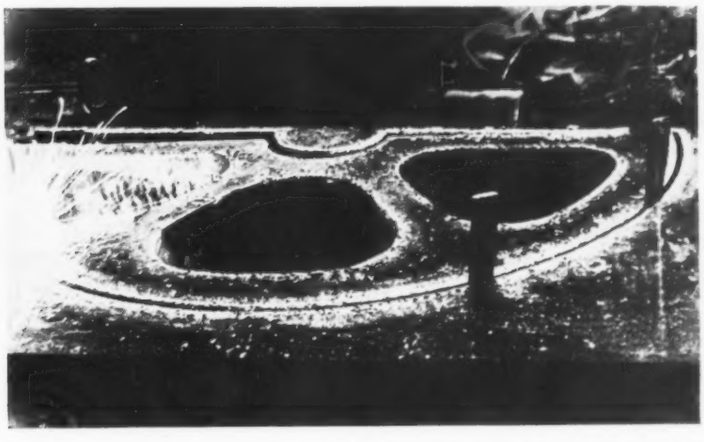


Fig. 2. A Nearly Completed Segment of Rotor Being Cut to Shape on Oxy-acetylene Cutting Machine



Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

J. A. M.—We operate a steam turbine that is lubricated by a circulating system containing 300 gallons of oil. Six months ago the unit was taken down, thoroughly cleaned, the bearings were put in first-class shape, and the entire system was tested for leakage. An excellent turbine oil was put in the unit and operation was continued until a week ago. Although there had been no leakage from the bearings or oil cooler, it was necessary to add 15 gallons to bring the oil level in the reservoir up to normal. What happened to this lost oil?

Answered by Editor of "Oil-Ways," Published by the Standard Oil Co. of New Jersey

When a lubricated moving surface is exposed to the atmosphere, there is always a greater tendency for the oil to evaporate than if the oil is stationary at the same temperature. In high-speed machinery such as steam turbines, this is particularly noticeable in that the air over the moving film is being constantly replaced and saturated with oil vapor. Even with the highest quality oil this will result in a loss which cannot ever be completely prevented. Less loss will be experienced, however, when a high quality turbine oil rather than one of mediocre quality is used.

A Problem in Drawing Shells

P. L. P.—Referring to the accompanying illustration, I would like to know if it is possible to make the shell shown complete in one operation, or, if not, how many operations are required. The metal used is deep drawing steel, 0.035 inch thick. Only a single-action press, with a 3 1/2-inch stroke, is available. I would also appreciate suggestions as to how the dies might be made to do this work most satisfactorily.

Answered by Herman Osswald
V & O Press Co., Hudson, N. Y.

This shell could not be made in one operation on a single-action press. To produce a shell on such a press, we would suggest the following operations:

First operation: Blank and cup shell.

Second operation: Redraw shell to proper dimensions.

Third operation: Trim shell on a flat-edge trimming punch and die, which would complete the trimming in one operation. Or the shell could be trimmed with horning type punches and dies, which would require four operations—one for each side and one for each end.

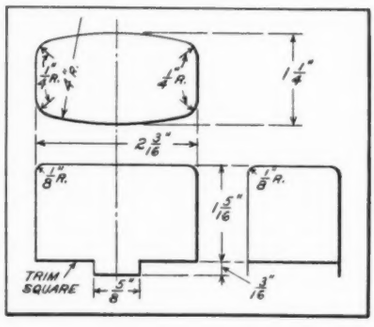
The dies would be as follows: For the first operation, a combination punch and die; for the second operation, a redrawing punch and die; for the third operation, a flat-edge trimming punch and die; or for the third and fourth operations, a horn type punch and die; and for the fifth and sixth operations, a horn type punch and die.

Another procedure might also be suggested:

First operation: Blank and cup shell.

Second operation: Redraw shell, leaving flange.

Third operation: Trim and redraw.



Shell to be Drawn

Although this method would leave a rough edge, it is suggested because, in many instances, this particular point is not of importance.

While a single-action press with a 3 1/2-inch stroke is available, we have no way of knowing whether or not the machine has sufficient capacity for this work. If we were to recommend a proper press, we would suggest one having a capacity equal to that of a V & O No. 2 1/2 geared press with a 3 1/2-inch stroke. This is a 25-ton capacity machine.

Aligning Long Lathe Beds

L. M. S.—I would like to know how to proceed in aligning long lathe beds, especially with respect to alignment in the vertical plane.

Answered by the American Tool Works Co.
Cincinnati, Ohio

Because the lifting, moving, or shipping of long-bed lathes is sure to cause distortion, it is essential that the alignment in the vertical plane be made as accurately as the leveling in the horizontal plane. To facilitate aligning the lathe bed accurately in both planes, we use leveling jacks under the legs,

as indicated in the accompanying illustration. Wedges actuated by the leveling screws are used in leveling up and aligning the bed in the horizontal plane, and the pusher screws are employed to obtain alignment in the vertical plane.

To check the alignment, equipment similar to that shown mounted on the carriage and on the ways at each end of the lathe is required. This consists of means for supporting and providing the proper tension on a piano wire which serves as the alignment gage. The wire must be held in accurate alignment with the carriage ways on the bed by the two auxiliary cross-bridges of cast iron, which are planed to fit the bed vees and which have suitable clamps for securing them in place when the wire is in tension.

At one end of each bridge are mounted two uprights, one of which is a journal for a revolving screw and nut, and the other a fulcrum stud having a V-groove in its upper face to receive the wire. The two fulcrum studs must be so machined that the V-grooves are at exactly the same position relative to the bed V-ways in order to insure accurate position of the wire.

A piano wire of about 18 gage is stretched between the two bridges. A little sag will take place, but as this is in the vertical plane, it will not affect the readings of the gage. The tool-rest, top slide, and swivel are removed from the bottom slide of the lathe carriage and replaced by the angle-bracket carrying a thumb-screw and a long nut having a small flat cap *A* on the screw end, as shown in the end view. Cap *A* is sufficiently large in diameter to cover the wire sag at any position along the bed. A bracket also supports the dial indicator in the horizontal plane in line with the wire.

After carefully leveling the machine by adjusting the pusher screws, proceed to align it in the following manner: First, move the carriage to one end and set the indicator to the wire, adjusting it to zero. Then move it to the opposite end and check the zero setting. Next move the carriage along the bed to a point near the first leg or contact on the foundation. Carefully set the thumb-screw so that cap *A* just makes contact with the wire and then just touch the wire with the indicator. If any error of alignment is noted, the thumb-screw and the indicator are held away from the wire until the bed is moved sidewise, after which a second reading is made against the wire.

Successive bed movements are made and indicator readings taken until a satisfactory alignment is obtained at the first leg position. Then these operations are repeated at each intermediate point until the entire bed is in alignment. Next, go back and check both the leveling and alignment to make sure that the moving of the bed has not changed the original settings.

Now, to insure having the bed retain its alignment, secure the wedges or other leveling means in place. If wedges have been driven under the legs, replace them by flat metal shims, accurately fitted between the foundation and the under side of the bed legs. Then, to prevent vibration of the building or of the machine itself from moving the shims, surround the legs with a wooden frame and fill in around the shims and legs with soft concrete grout, or if desired, small pads of melted sulphur. The sulphur is preferable, as it will not shrink.

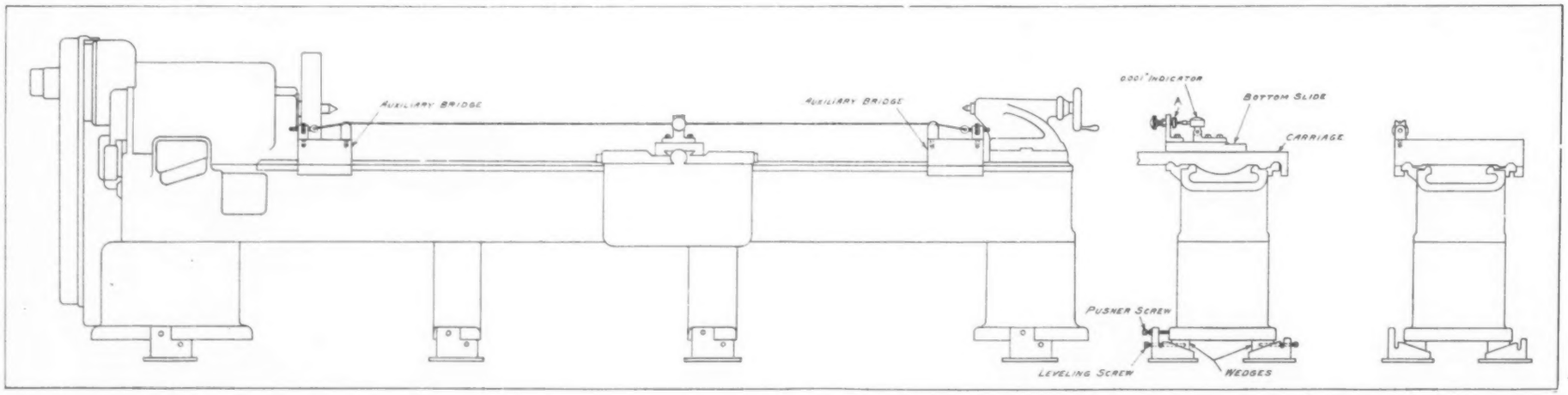


Diagram Showing Method of Using Piano Wire and Leveling Jacks in Aligning Long Lathe Beds

Milling Machine Units and Fixtures Designed for High Production

Some Interesting Examples of Special Set-Ups Recently Applied to Hydromatic Milling Machines for the Rapid Machining of Automotive Parts

By H. J. DODS, Cincinnati Milling Machine Co. and Cincinnati Grinders, Incorporated, Cincinnati, Ohio

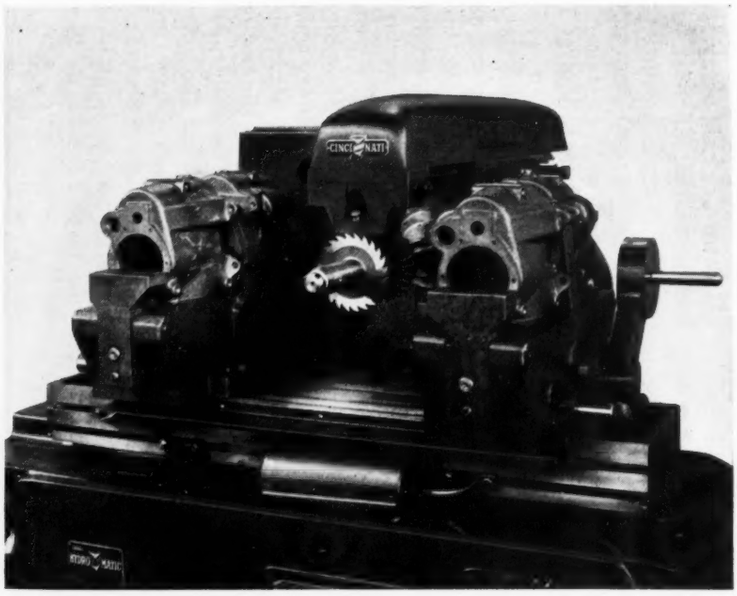


Fig. 1. Set-up for Rapid Milling of Bolt Lugs on Transmission Case Covers

MANY manufacturers find it desirable to keep their machine tools equipped so efficiently that their productive capacity is always somewhat in excess of the actual output requirements. This policy provides a safety factor for unforeseen demands. The fixtures and special machine units described here were devised by the Cincinnati Milling Machine Co. to provide the desired production capacity on automotive and similar parts machined on Cincinnati Hydromatic machines.

Fig. 2. Fixture Designed to Hold Two Crankshafts for Simultaneous Milling Operations on Locating Pads

The fixtures shown in Fig. 1 were designed for milling two bolt lugs on transmission case covers. Two covers are held in each fixture as shown, being located from dowel-pins in the center plate. The large weighted lever at the end of each fixture is pinned to a camshaft. Three-quarters rotation of the lever turns the cam through an arc which is sufficient to actuate two spreader pins, which, in turn, push against the lower ends of the swivel clamps.

The cap type arbor support between the two cutters allows the arbor with its gang cutters to be removed for sharpening without disturbing the relative positions of the cutters. The sequence of operations with this set-up is as follows: First, rapid advance of the table to bring the cutters into operation on the work held at one end of the table; second, unload and load the other fixture while the cut is being taken on the work at the opposite end of the table; third, rapid advance of the table in the reverse direction to the opposite end, bringing the new

pieces of work into the cutting position; fourth, repeat the unloading and loading operation. The feed used for this job is 4 inches per minute and the total elapsed time per piece is 0.33 minute.

Table dogs are set for a continuous automatic operating cycle with a safety stop position in the center of the cycle to safeguard the operator. This feature is desirable when the two-cycle feed is employed, in case the manual operation of loading and unloading lags behind the cutting time.

Set-Up for Milling Pads on Two Crankshafts Simultaneously

An efficient set-up for milling locating pads on two crankshafts is shown in Fig. 2. The special fixture developed for this operation is mounted on a 12- by 24-inch indexing base. The fixture holds two crankshafts in parallel. The crankshafts are located from the centers and the two ends and from one of the rough crankpins, under which a V-block is raised. In addition to clamping the work between centers, side clamps are also provided. Adjusting screws are located in back of the work on the side opposite the clamps to provide adequate support under the clamping pressure.

To start the machine cycle, the operator removes and loads one crankshaft, then swings the index base 180 degrees, and engages the table rapid advance; the feed for milling is then automatically tripped and one end of each crankshaft milled. Next the table automatically trips to rapid return and stops, thus completing the cycle, which gives one crankshaft milled on both ends. Two high-speed steel half side mills rotating at a speed of 63 revolutions per minute are used for this work. A feed of 8 inches per minute is employed. The production time per piece is 1.24 minutes.

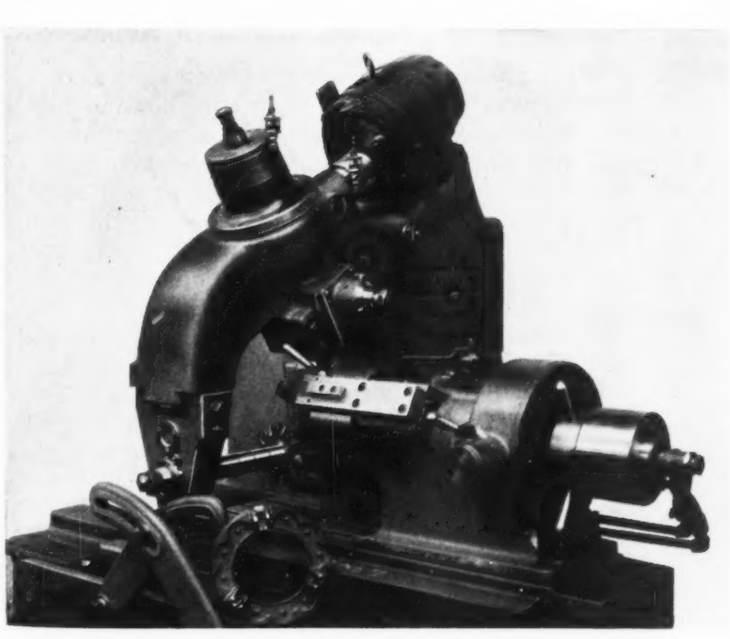


Fig. 3. Special Milling Machine Unit Developed for Milling Slots in Clutch Pressure Plates

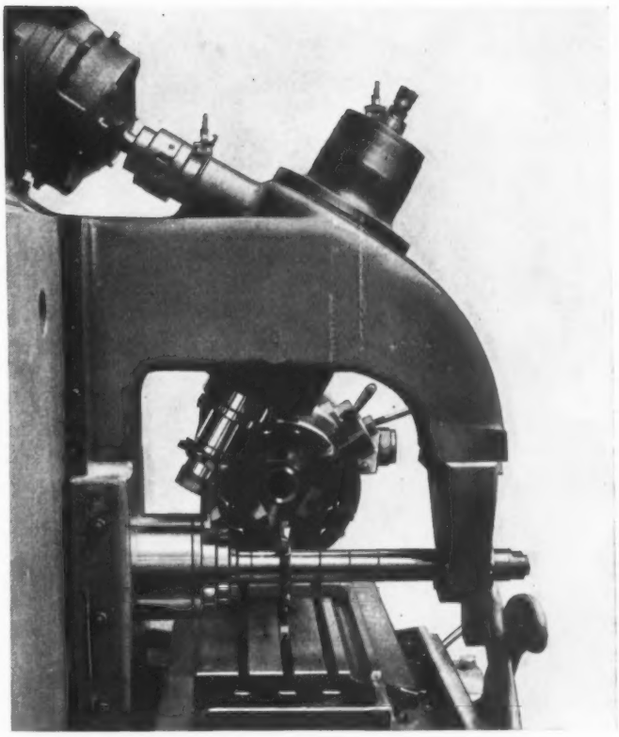


Fig. 4. End View of Set-up Shown in Fig. 3, Indicating Manner in which Two Cutters Operate Simultaneously

A special spindle head mounted on a standard 3- by 24-inch plain Hydromatic for simultaneously milling two slots in each of the three lugs on clutch pressure plates is shown in Figs. 3 and 4. A special 120-degree, air-clamping, hand-indexing fixture mounted on the table holds one clutch pressure plate. The work is located from three surfaces: the back face, the turned outside diameter, and the third lug. A cutter 6 inches in diameter is driven by a standard spindle at a speed of 48 revolutions per minute. A cutter 4 inches in diameter is mounted on a special stub arbor and driven by a special 60-degree milling attachment at a speed of 75 revolutions per minute. This attachment is driven by a two-horsepower geared motor through a standard automotive rear-axle spiral-bevel gear and pinion, the reduction in the gearing at the spindle and in the geared motor giving the desired speed of 75 revolutions per minute for the cutter.

The novel feature of the latter installation is the use of the geared motor and the standard ring gear and pinion for driving the angular spindle attachment. The feed rate is automatically varied to suit the amount of metal removed by means of a standard variable-feed attachment. The production time on this milling job is 0.92 minute per piece.

A further development of the installation shown in Figs. 3 and 4 is illustrated

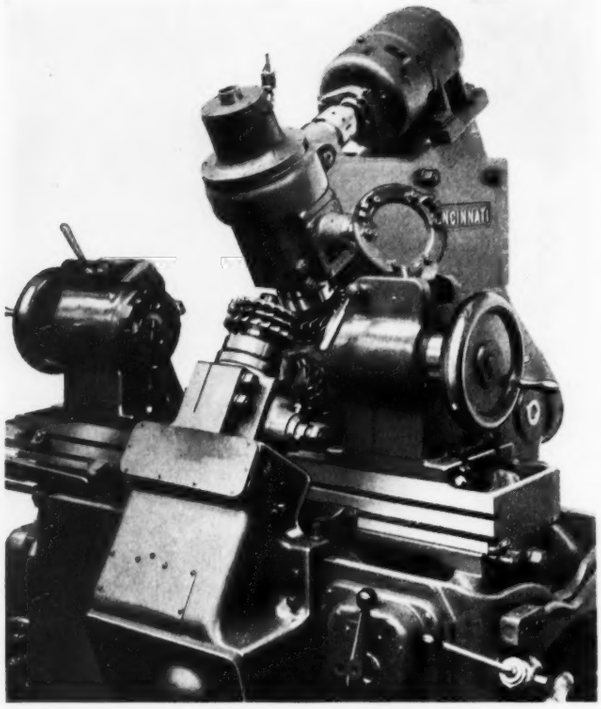


Fig. 5. Further Development of Machine and Equipment Shown in Figs. 3 and 4

in Fig. 5. The latter machine is similar to the preceding one, except that a third spindle carrier is mounted on the operator's side of the bed. The additional spindle is driven at a speed of 43 revolutions per minute.

Each spindle has a gang of three cutters which finish the slot and sides of each lug complete. A hand-operated fixture is mounted on each end of the table. While the piece in one fixture is being milled, the fixture at the other end of the table is unloaded and loaded. Two operators are required to keep pace with the machine, which produces 350 clutch plates an hour.

* * *

First Automatic Metal-Cutting Machines

The first machine tools with automatic features made their appearance during the Civil War, and in the years following the Civil War a great deal of attention was given by manufacturers and designers to machines that partially eliminated hand operations. It was in the seventies and early eighties, however, that machines completely automatic in their action were first brought out, these machines being the forerunners of the present-day single-spindle automatics. Automatic gear-cutting machines made their first appearance in 1877. In the nineties, a successful multiple-spindle automatic made its first appearance, and since that time, the development of automatic machines for metal working has been very rapid, covering practically every type of machining operation.

Marked Improvement in Industrial Conditions

Motor vehicle production in the first quarter of 1935 was the best since 1929, according to the Automobile Manufacturers' Association. It is estimated that the output in March was close to 450,000 units, making the industry's production for the first quarter approximately 1,110,000 vehicles, an increase of 48 per cent over the same period last year. The production during the first three months of the year exceeded by more than 100,000 cars the production during the first three months of 1928. Only three times in the history of the industry—in 1929, 1926, and 1924—has the motor output during the first three months of the year been greater.

Sales billed by the General Electric Co. for the first quarter of 1935 amounted to over $40,000,000 as compared with slightly less than $35,000,000 for the same quarter a year ago.

The Bantam Ball Bearing Co. of South Bend, Ind., reports an increase in shipments for the first quarter of 1935 of approximately 50 per cent over the first quarter in 1934. This represents a volume of approximately five times that for the corresponding period of 1933. Due to a steady increase in sales of heavy-duty bearings for steel mill and other heavy-duty service, the company has increased its facilities for handling this type of work by 50 per cent within the last three months.

Westinghouse Electric & Mfg. Co. announces that it has received a contract from the United States Navy Department amounting to approximately $1,750,000 for electrical equipment for eighteen 1500-ton destroyers.

* * *

Building up Friendly Employe Relations

When the annual report to the company's stockholders was issued recently by the Ludlum Steel Co., Watervliet, N. Y., a report was also issued to the employes giving in simple yet detailed form a comprehensive account of the company's affairs—telling about the total business done by the company, its profits and its losses, and how its expenses are divided between materials, supplies, wages, power, taxes, advertising, interest, etc.

It is believed by the company that this method of keeping the employes informed about the business is an important factor in maintaining the interest of the employes in the company and in building up a friendly cooperative relationship between the company and its employes.

* * *

The problem of any community or nation should be, not how to limit production so that all shall have *less*, but how to equitably distribute an increasing production so that all may have *more*.

The Important Characteristics of a Cutting Fluid

Although the amount of study and research applied to cutting fluids has increased steadily during the last few years, there is still a considerable divergence of opinion as to the true function of a cutting fluid. It has been said, for example, that lubrication plays little, if any, part in producing a good finish, accurate size, and long tool service, but that its most important purpose is to dissipate heat. Therefore, a cutting fluid that possesses a high degree of heat-absorbing properties will prove most efficient.

Some facts relating to these functions of a cutting fluid and the importance of proper tool design were given in the *Houghton Line*, published by E. F. Houghton & Co., Philadelphia, Pa. The information given is based on thousands of tests made by the research staff of this company.

No cutting fluid can overcome the faults of a poorly designed or improperly hardened tool. The clearance of the tool must be correct and the rake angle must be such as to provide for the proper flow of the chip in order to prevent the metal from building up on the nose of the tool. Wrong heat-treatment of the tool will result in short tool life and poor finish.

Insufficient or incorrect clearance causes high frictional heat which breaks down the cutting fluid, shortens the tool life, and frequently results in inaccurate size and finish. An unsuitable rake angle on the face of the tool will also cause high frictional heat, due to the pressure of the chip on the tool. It may also cause the chips to pile up on the cutting edge of the tool, so that the metal is pushed off instead of being cut cleanly.

It is generally understood that tools must be ground differently when water emulsions are used than when straight cutting oils are used. When water emulsions are used, a greater amount of clearance is often necessary and the rake angle must be changed. In view of these facts, it is not surprising that the coolant is often thought to be poor, when the fault is in the form of the tool.

In addition to high heat-dissipating properties, the cutting fluid must have proper film strength to reduce the friction caused by the work sliding past the clearance of the tool and by the chip sliding over the rake angle of the tool. Obviously, the amount of film strength required will vary according to the type of metal being machined and the depth and speed of the cut.

Threading, reaming, broaching, and some types of boring and forming operations are examples of heavy-duty work, particularly when alloy steels are being machined. For such work, the cutting fluid must have high heat-dissipating properties, as well as high film strength on account of high tool pressures. The fluid must not break down under the high temperature to which it is subjected.

Another important factor not generally understood is fluidity. This affects the penetrating quality of a cutting fluid. A cutting fluid that has a high degree of heat absorption and maximum film strength would fail if the oil did not penetrate directly back of the cutting edge of the tool, both on the clearance and rake faces.

At one time, lard oil and other animal and vegetable oils, either in their pure state or mixed with linseed oil and white lead, were used. After the advent of high-speed and other alloy steels, which permitted heavier cuts and higher cutting speeds, lard oil failed to give satisfactory results. To meet the requirements of this new cutting material, a sulphurized mineral oil blended with saponifiable matter has been developed. The success of this cutting oil indicates that a sulphurized oil with saponifiable matter and with mineral oil of prescribed viscosity forms an economical cutting fluid. The amount of sulphur and saponifiable matter and the viscosity required depend on whether it is to be used on heavy-duty or light work.

In the average machine shop, two straight cutting oils (except, of course, water emulsions) will meet most requirements. In fact, most needs can be readily met with one base oil by diluting it to suit requirements or by purchasing an oil properly diluted for heavy-duty work and then further diluting this oil for the light machining operations.

* * *

An Experience in Tool Hardening

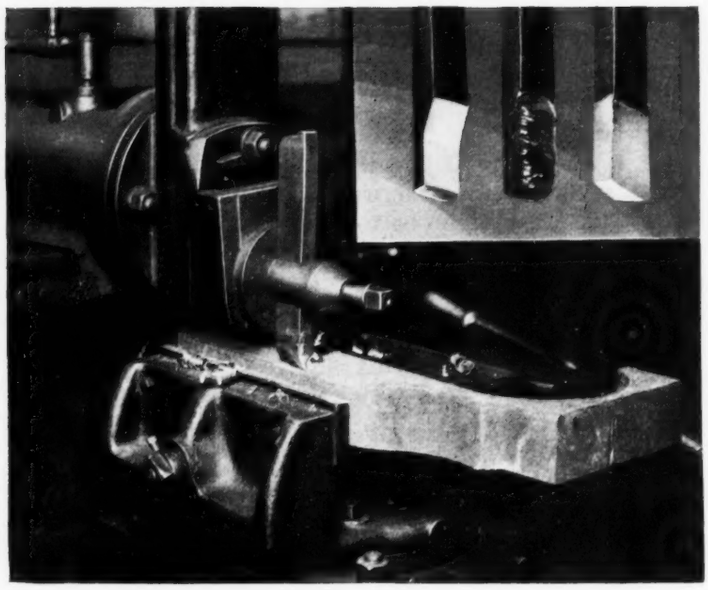
The results obtained from the hardening of tool steels and high-speed steels depend upon so many factors that it is not always easy to locate the trouble when satisfactory results are not obtained. At a large manufacturing plant, difficulties were recently experienced in turning large chilled rolls. These had formerly been turned by a certain grade of high-speed steel, hardened in a definite manner. After a year or so, similar rolls had to be turned again, but it was found difficult to get tools that would stand up.

Investigation showed that the composition and hardness of the rolls were as nearly identical as possible with these properties in the earlier rolls. It was also thought that the heat-treatment of the tools was identical; and so it was, except for the fact that there had been a change in the water used and also in the coke for the fire in which the tools were heated.

By using spring water instead of city water, and a harder coke containing less sulphur, the difficulties were removed. It was also found that the tools were greatly improved by adding sufficient salt to the water to make a brine heavy enough "to float a potato." A small amount of muriatic acid added to the quenching bath also proved a distinct factor in securing greater hardness—about fifteen teaspoonfuls of acid to ten gallons of water.

Electric Arc Provides New Type of Cutting Tool

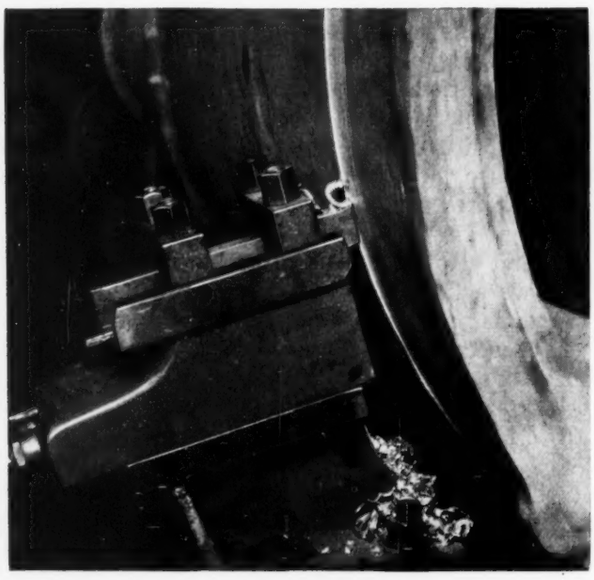
New Electric Welding Electrode Opens up Broad Possibilities in the Economical Production of High-Speed Metal-Cutting Tools



FEW developments in arc welding appear to have greater possibilities in the machine-building industry than the electrode known as "Toolweld," brought out recently by the Lincoln Electric Co., Cleveland, Ohio. This tool-steel electrode was designed primarily for restoring the worn cutting edges on metal-working and wood-working tools.

The remarkable service given by lathe and planer tools, milling cutters, cutting and forming dies, drills, and other metal-working tools reconditioned by the application of Toolweld to their worn cutting edges indicates that this material has even greater possibilities in the production of new tools. Such tools can, of course, have their cutting edges renewed as often as they become worn out.

The procedure in making tools of this kind consists simply of depositing the Toolweld on cold-rolled steel or similar material, thus giving high-speed steel cutting edges to low-priced steel shanks.



In all the plants where this electrode has been thoroughly tested, results have indicated that the metal deposit is in all essential respects equal to high-speed steel. Those who have tried the electrode are enthusiastic in their comments on the savings that this new tool material makes possible.

The three views in the upper right-hand corner of the heading illustration show, from left to right, the end of a cold-rolled steel shank prepared for the application of the tool-steel electrode; the same shank after the electrode has been applied; and the finished tool ground to the proper shape for use in a lathe.

The shaper tool shown in the heading illustration was made in fifteen minutes by the machine operator with a Toolweld electrode and a piece of left-over steel. The work done with this tool consists of cutting a 40-point carbon steel part. It was found that this tool would take a deeper cut and last longer than the tool-steel tool formerly used. The body and shank of a tool made by this new method can be made of a low-alloy steel costing only five or six cents a pound. Generally, hot-rolled steel is preferred to cold-rolled steel for the shanks of such tools

The Toolweld electrode provides a deposit of high-speed tool steel that maintains its hardness of 55 to 65 Rockwell C scale under relatively high temperatures, up to approximately 1000 degrees F. It will also withstand shock on the cutting edges to a highly satisfactory degree. The deposit can be heat-treated in the same manner as high-speed steel. Such treatment will, in general, increase the hardness by 2 or 3 points on the Rockwell scale and give somewhat longer life. However, heat-treat-

Fig. 1. Turning Cast Steel with an Ordinary Alloy-steel Tool Faced with Toolweld Electrode

Fig. 3. Machining a Hard Grade A Meehanite Casting in a Vertical Turret Lathe with a Tool Made by Applying Toolweld Electrode to an Alloy-steel Shank

ment is not necessary in the majority of applications of Toolweld.

Typical applications of tools of alloy steel with cutting faces of Toolweld are shown in Figs. 1, 2, and 3. In Fig. 1 is shown an ordinary alloy-steel tool faced with Toolweld electrode, which costs one-third as much as the tool previously employed for this lathe job. The service given by this tool is in every way as satisfactory as that of the tool formerly used.

In Fig. 2 is shown a tool made with Toolweld electrode applied to alloy steel. This tool is employed in turning a roll in the machine shop of a steel plant. It proved more durable for this service than the regular high-priced tool steel ordinarily used, although it costs but a few cents.

A vertical turret lathe tool made by the same process is shown in Fig. 3. This tool is used in a vertical turret lathe, where it has successfully met every test for hardness and durability in cutting a hard Grade A Meehanite casting.

* * *

Roller-Bearing Locomotives

Two large, high-speed, steam locomotives for the Lehigh Valley Railroad are provided with roller bearings on all axles, including the driving axles. The bearings were furnished by the Timken Roller Bearing Co. The Lehigh Valley Railroad also placed with the Timken company orders for roller bearings to be used under the engine trucks on five locomotives. All the locomotives were built by the Baldwin Locomotive Works.

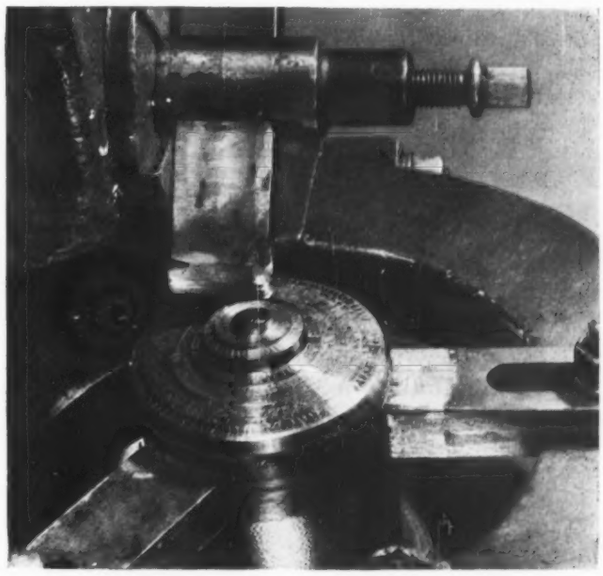
Fig. 2. Turning a Steel Mill Roll with a Toolweld-faced Tool Costing Only a Few Cents

When to Use Oildag Lubricant

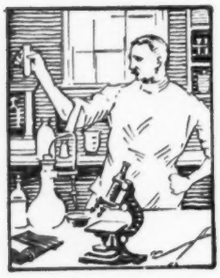
According to the Acheson Oildag Co., small devices for which Oildag is recommended as a lubricant may be divided roughly into three classes: (1) Mechanical movements or devices that must function without failure, such as those employed in fire-alarm systems, automatic telephone exchanges, news and financial tickers, etc. (2) Small machines that are frequently neglected and that embrace in a large measure such household devices as ironing machines, vacuum cleaners, washing machines, fans, etc. (3) Mechanisms that are not provided with ducts or oil-cups for the admission of lubricants, but that in time develop wear or undue play. This group includes variable condensers, variometers and automatic tuning equipment used in radio broadcast receivers, as well as miniature motors, mechanical toys, etc.

* * *

A. Ainsworth, 3 Chestnut St., St. Catherine's, Ontario, Canada, would like to obtain copies of some of MACHINERY'S Reference Books now out of print: No. 100, "Designing and Cutting Cams"; No. 101, "Circular Form and Cut-Off Tools"; No. 103, "Internal Cutting Tools"; No. 25, "Deep Hole Drilling." He requests any reader of MACHINERY that has these books to communicate with him.



MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

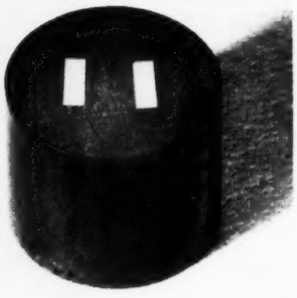
Bakelite Used for Mounting Metallurgical Specimens

Metallurgists are frequently confronted with the problem of mounting small metal specimens, such as wires, springs, sheets, and powdered materials, so that they can be examined satisfactorily under the microscope. Sometimes it is necessary to mount small specimens, so as to insure that the surface to be examined will be held in a true plane. Another reason for mounting small specimens is that standardized holders facilitate the application of a uniform pressure in the grinding and polishing process. Less time is required for grinding and polishing when specimens are mounted.

Bakelite Molded has been adopted by several research laboratories for mounting small specimens as outlined. Two pieces so mounted are shown in the illustration. Mountings of this material do not heat up, and they can be polished readily without clogging grinding wheels or emery paper. Dust ground from the mountings can be easily brushed from abrasive wheels.

Bakelite Molded takes an especially good hold on the specimens. Another advantage is that various colors can be used to obtain the best possible contrast with the specimens.

A hydraulic press designed particularly for mounting specimens in Bakelite Molded has been developed by the Wilkens-Anderson Co., Chicago, Ill., according to suggestions of Professor J. F. Oesterle of the University of Wisconsin.



Two Metallurgical Specimens Mounted in Bakelite Molded to Facilitate Microscopic Examination

Wrought Iron Increased in Strength by Adding Nickel

During the last ten years or so, there has been a considerable demand for wrought iron of greater tensile strength than has been available. To meet this demand, the A. M. Byers Co., Pittsburgh, Pa., is now manufacturing, on a commercial basis, wrought iron containing up to 3.5 per cent nickel.

The addition of approximately 3 per cent nickel to wrought iron increases the yield point about 50 per cent and the ultimate tensile strength approximately 25 per cent. For example, standard wrought iron has a yield point of 30,000 pounds per square inch and a tensile strength of 48,000 pounds per square inch, while 3 per cent nickel wrought iron has a yield point of 45,000 pounds per square inch and a tensile strength of 60,000 pounds per square inch. Standard wrought iron has an elongation of 25 per cent in 8 inches and a reduction in area of 45 per cent, while a 3 per cent nickel wrought iron has an elongation of 22 per cent and a reduction in area of 40 per cent.

In addition to raising the yield point and increasing the tensile strength, the alloying of nickel with wrought iron improves the hardness. In low-temperature service, nickel wrought iron is of especial value, because the metal retains its toughness without an appreciable loss in ductility. Charpy impact tests at room temperature and at temperatures as low as — 112 degrees F. have shown that nickel increases the impact strength of wrought iron.

A typical chemical analysis of nickel wrought iron is as follows: Carbon, 0.04 per cent or under; manganese, 0.05 per cent or under; phosphorus, 0.10 to 0.12 per cent; sulphur, 0.03 per cent or under; silicon, 0.10 to 0.15 per cent; nickel, 2.75 to 3.25 per cent; and slag, 2.75 to 3.25 per cent. The composition of standard wrought iron is the same, except for the nickel content.

The ability of wrought iron to resist corrosion is due primarily to the thousands of non-rusting

slag fibers distributed throughout the base metal. The addition of nickel to wrought iron does not disturb the uniform distribution of these non-rusting slag inclusions. Nickel wrought iron can be welded successfully by either the oxy-acetylene or electric-arc methods. It can be easily machined.

The principal application thus far for nickel wrought iron has been in the making of pump sucker rods, which are subjected to severe corrosive conditions and high stresses, even under the best operating conditions. Limited field tests have shown that, in this application, nickel wrought iron has a service life many times greater than that of other commonly used materials. Other possible applications of nickel wrought iron are in the manufacture of chain, staybolts, engine bolts, railroad draw-bars, boilers, and ship plates.

Ten Types of Thermostatic Bimetal for Various Temperature Ranges

Two sheets of different metals, one having a high thermal expansion and the other a low expansion, are permanently fused together to form a thermostatic bimetal. Material of this kind is used extensively for automatically controlling the operation of devices that are heated or cooled by electricity, oil, or gas, as for example, electric refrigerators, irons, and toasters, gas ranges, water heaters, and domestic oil burners.

Precious metals were first used as bimetal elements but the high cost limited the application of such materials. However, with the substitution of brass, steel, and special alloys for gold and silver, thermostatic bimetal has ceased to be a novelty and has been adopted for hundreds of uses.

Truflex thermostatic bimetal is now made by the General Plate Co., Attleboro, Mass., in ten different types for various active temperature ranges from — 50 degrees F. to as high as 1000 degrees F. The maximum temperature range extends as high as 1200 degrees F.

While this company recommends that bimetal elements be supplied in such finished forms as helical coils, spiral coils, rings, flat pieces, or U-shapes, the concern can also supply the material in sheets up to 8 inches in width. The material is regularly produced in thicknesses of from 0.010 to 0.100 inch, varying in increments of 0.005 inch. Bimetal can be supplied in coils or in various straight lengths.

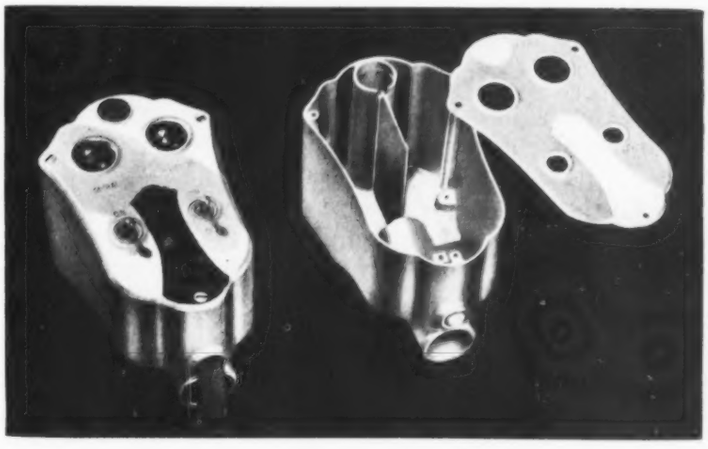
Monel Metal with a Tensile Strength of 160,000 Pounds per Square Inch

After twelve years of research, the International Nickel Co., Inc., 67 Wall St., New York City, has produced a new type of Monel metal which combines the strength of alloy steels with the corrosion resistance of regular Monel metal. The new alloy, known as K Monel, has practically the same analysis as regular Monel metal, except that about 4 per cent aluminum is added, together with fractional amounts of other elements. The new alloy is readily heat-treated, and in its fully hardened condition, has a Brinell hardness of over 350, although it is available in softer forms. Its tensile strength is over 160,000 pounds per square inch.

Aluminum Foil Seals Milk Bottles Against Germs and Dirt

Caps made of aluminum foil are being used by a number of enterprising dairies and milk dealers to seal bottles of milk effectively against dust, germs, water, and air. Machines for making these caps and for fastening them securely on the milk bottles are licensed to users by the Sanitary Metal Cap Corporation, Hills Bldg., Syracuse, N. Y. The machines are designed for use in conjunction with bottle-filling machines.

The caps are formed by each machine at the rate of 120 a minute from rolls of aluminum foil. As the filled bottles of milk travel around the filling table, two plungers press the metal caps firmly over the bottles. These caps cannot be resealed after having once been opened.



A Difficult Zinc-base-alloy Die-casting Made by the Superior Die Casting Co., Cleveland, Ohio. This Thermostat Control Housing is 5 Inches Deep, with an Over-all Length of Approximately 8 Inches. The Wall Thicknesses are 3/32 Inch. Partitions, Slots, and Holes are Cast. All Parts are Chromium-plated. Fine Smooth Surfaces and Sharp Outlines Effect Definite Savings in Plating Costs

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Threading and Tapping Equipment

LANDIS MACHINE CO., INC., Waynesboro, Pa. New edition of the Landis Handbook, compiled for users and operators of Landis threading and tapping equipment. This book contains complete instructions regarding the use of this equipment, with the object of enabling the most efficient and economical results to be obtained. The instructions include the grinding of Landis chasers, the operation of Landis threading heads and machines, the grinding of Landis tap chasers, and the operation of Landis collapsible taps. The book also treats of the adaptability of Landis die-heads for cutting special threads and includes data on special threads such as are encountered in the manufacture of airplanes, automobiles, railway cars, locomotives, and machine tools.

Thrustors

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-1614A, describing the advantages of thrustor control and illustrating typical installations of this equipment, which indicate its wide field of application.

Bulletin GET-459A, containing engineering data covering the application of GE thrustors for operating machinery of different types, including power presses, spot-welding machines, and conveyors, as well as almost any type of device that requires a straight-line motion, such as valves, brakes, clutches, etc. Diagrammatic sketches suggest the innumerable ways in which thrustors can be used. This book should be a valuable guide to those contemplating the installation of this equipment.

Gear-Cutting Machines

NEWARK GEAR CUTTING MACHINE CO., INC., 69 Prospect St., Newark, N. J. Book entitled "Newark Gear Cutting Instructions," containing definite and complete instructions regarding the cutting of gears, which should be useful to any gear-cutting department. While the instructions relate specifically to the operation of Newark gear-cutting machines, the book also contains considerable information on gearing of value to all gear users. It includes a table of tooth sizes for AGMA herringbone gears, a table of chordal tooth sizes for spur gears, a table of tooth parts for diametral and circular pitch gears, and formulas for gear calculations.

Stainless Steel Wire Rope

HAZARD WIRE ROPE CO., Wilkes-Barre, Pa. Catalogue illustrating and describing the construction and application of what are known as "Korodless" ropes—wire ropes made from an alloy steel containing 18 per cent chromium and 8 per cent nickel, and which, therefore, is in the corrosion-resisting or stainless-steel class. These wire ropes are stainless throughout, of exceptional strength, have high fatigue resistance, and are suitable for any purpose where these qualities are of value, as for cranes and hoists exposed to the weather or corrosion, etc.

Drill Grinders

WILLIAM SELLERS & CO., INC., 1602 Hamilton St., Philadelphia, Pa. Bulletin illustrating and describing the Sellers No. 05-D drill grinder, a modern precision grinder for small twist drills. The circular shows by large-scale drawings the successive steps in grinding a drill with this equipment.

Bulletin entitled "Common Causes of High Drilling Costs," outlining several different causes of high drilling costs and describing how these conditions can be rectified by the use of a Sellers drill grinder.

Standard Appliances for Anti-Friction Bearing Mountings

BEARING APPLIANCE CO., Times Bldg., Ardmore, Pa. Bulletin A, containing dimensions and application data covering a line of standardized appliances for ball and roller bearing mountings. The appliances listed include housing covers, caps, flingers, seals, closures, and fittings. The catalogue also contains diagrams showing applications of the designs listed on a wide range of types and sizes of bearings.

Tungsten and Molybdenum Carbide Metal

TUNGSTEN ELECTRIC CORPORATION, 540 Thirty-ninth St., Union City, N. J. Catalogue containing information on Teco metal, a carbide material of great toughness and hardness, suitable for cutting tools, wearing parts, wire-drawing dies, etc. The field of application is outlined, and complete tables of blank sizes and dimensions of standard tools and bits are included.

Dial Indicators

L. S. STARRETT CO., Athol, Mass. Catalogue covering the complete line of dial indicators made by this concern. Many important design and construction features of these indicators are described, and in addition to the standard line, many special dial indicators applied to bench gages, sheet gages, test indicators, cylinder gages, distortion or strain gages, vibration testers, etc., are shown.

Pipe and Bolt Threading Equipment

BEAVER PIPE TOOLS, INC., Warren, Ohio. Folder explaining the difference between the fully adjustable and the semi-adjustable types of pipe threading tools. Circular illustrating and describing the Beaver Model A portable pipe and bolt threading machine. Specification Sheet for Beaver Models A and B portable pipe and bolt threading machines.

High-Speed Steel and Tungsten-Carbide Tools

WESSON CO., 1050 Mt. Elliott Ave., Detroit, Mich. Loose-leaf catalogue covering this company's complete line of standard and special-purpose high-speed steel and cemented-carbide tipped counterbores, inverted spotfacers, multi-dimension cutters, milling cutters, reamers, floating holders, tool bit holders, three-way vises, and lapping machines.

Indicating and Recording Instruments

BROWN INSTRUMENT CO., Philadelphia, Pa. Folder illustrating applications of Brown indicating and recording instruments for measuring temperatures, percentage of carbon dioxide, flows, pressures, etc. The bulletin gives actual figures concerning savings effected in steam costs by the use of these instruments in different plants.

Spray Painting and Finishing Equipment

BINKS MFG. CO., 3114 Carroll Ave., Chicago, Ill. Bulletin AD 114, containing descriptions and prices of new additions to the Binks line of spray painting equipment, as well as a general outline of the entire line, which includes spray guns for finishing, cleaning, and oiling; air regulators; compressors; portable spray outfits, etc.

Hydraulic Surface Grinders

PRATT & WHITNEY CO., Hartford, Conn. Catalogue illustrating and describing the mechanical details and improvements incorporated in the Pratt & Whitney 14-inch hydraulic surface grinder. Typical examples of work performed on this machine are shown and production figures are given. Complete specifications are included.

Self-Opening Die-Heads

GEOMETRIC TOOL CO., New Haven, Conn. Bulletin describing the Geometric Styles D and DD stationary self-opening die-heads for hand screw machines, turret lathes, etc. Bulletin descriptive of Geometric Style DS floating self-opening die-heads for use on Brown & Sharpe and other single-spindle automatics.

Scientific Instruments

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago, Ill. Bulletin 133, on spectrometers and accessories, supplementing Catalogue L-1. Catalogue B-1, covering this company's line of precision time-recording devices, including chronographs, photo-electric relays, stop watches, speed indicators, etc.

Silent Chain Drives

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill. Book No. 1425, describing the exclusive features of the Link-Belt Silverstreak silent chain drives. Many illustrations are included showing the wide field of application, on both long and short centers, for which these high-speed chain drives are suitable.

Taper-Spline Hobbing Machines

BARBER-COLMAN CO., Rockford, Ill. Bulletin describing the construction and advantages of the Barber-Colman taper spline for fastening a member on the end of a shaft. The circular also illustrates and describes the Barber-Colman taper-spline hobbing machine.

Forged Flanges

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago, Ill. Bulletin listing the various types of forged steel flanges carried in stock by this company. The bulletin features two special types of forged steel flanges—the high-hub boiler flange with extra length hub and the double-hub boiler flange.

Steels

UNION DRAWN STEEL CO., 232 Harsh St., Massillon, Ohio. Bulletin entitled "Cold Drawing Gives Steel 30 to 40 Per Cent More Tensile Strength . . . 70 to 100 Per Cent Higher Yield Point." Revised chart of S A E standard steel specifications covering carbon and alloy steels.

Simplex Jacks

TEMPLETON, KENLY & CO., LTD., 1020 S. Central Ave., Chicago, Ill. Catalogue, Form 235, illustrating and describing Simplex screw and lever jacks and trench and timber braces for railroads, coal mines, contractors, motor trucks, and general industrial use.

Abrasive Cutting Machine

ANDREW C. CAMPBELL DIVISION of AMERICAN CHAIN CO., INC., Bridgeport, Conn. Folder illustrating and describing the Campbell Model 302 horizontal wet abrasive cutting machine, designed primarily for making long cuts through flat or slab materials.

Gear Burnishing Tools

NATIONAL TOOL CO., Cleveland, Ohio. Bulletin announcing a new gear burnishing tool known as the "Burni-Shave" that burnishes and shaves gears in one operation. A "Red Liner" chart shows the accurate results obtained with these tools.

Presses

LUKENS STEEL CO., Coatesville, Pa. Bulletin entitled "World's Largest Press Brake," illustrating a press with 18 feet working length of die surface, designed for bending, flanging, forming, and multiple punching of both light and heavy steel plate.

Centrifugal Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-310-B4A, descriptive of Worthington Types C, CA, and CB centrifugal pumps. Bulletin W-323-B3, on Worthington self-priming centrifugal "Monobloc" pumping units.

Material-Testing Equipment

HERMAN A. HOLZ, 167 E. 33rd St., New York City. Bulletin illustrating and describing the Oxydator, an apparatus for the determination of the oxidability of oils, paints, varnishes, and other organic materials that deteriorate through oxidation.

Synthetic Plastics

TOLEDO SYNTHETIC PRODUCTS, INC., Toledo, Ohio, is issuing a house organ known as the "Plaskon Parade," with the object of showing to prospective users the many possible applications of Plaskon in a wide variety of industries.

Presses

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 335, describing the many improved features incorporated in Niagara A-5 heavy-duty presses. Complete specifications of the various types are included.

Zinc Dust Paint

NEW JERSEY ZINC SALES CO., INC., 160 Front St., New York City. Booklet containing information on metallic zinc powder in industrial paint and the qualities that make zinc dust paint especially suitable as a metal protective finish.

Welding and Cutting Equipment

CRAFTSWELD EQUIPMENT CORPORATION, 250 W. 54th St., New York City. Service Bulletin 235, listing the welding and cutting equipment, supplies, and accessories made by this company, and giving operating suggestions.

Lighting Equipment

BENJAMIN ELECTRIC MFG. CO., Des Plaines, Ill. Catalogue 26, containing complete listings, descriptive material, and engineering data on reflectors, lighting equipment, floodlights, fittings and sockets, and signals.

Cable Connections

DALLETT CO., 177 W. Clearfield St., Philadelphia, Pa., Circular describing the features of the Dalweld detachable cable connectors, suitable for shop and field work, and for use in connection with welding equipment, etc.

Foundry Ovens

GEHNRICH CORPORATION, Skillman Ave. and 35th St., Long Island Cit N. Y. Bulletin 100, describing Gehnrich foundry ovens of various types, for core baking, mold drying, low-temperature heat-treatment, and japanning.

Brazing Flux

HANDY & HARMAN, 82 Fulton St., New York City. Bulletin 9, describing a new brazing flux for low-temperature brazing, known as "Handy Flux." The circular includes directions for using this brazing flux, and price list.

Plating Barrels

UDYLITE CO., 1651 E. Grand Blvd., Detroit, Mich. Circular illustrating and describing the principal features of the Udylite plating barrel, which is designed to secure maximum strength and durability.

Honing Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 135, describing the features of construction and advantages of the Barnes new No. 5 horizontal, self-oiling, hydraulic honing machine.

Portable Industrial Cleaners

IDEAL COMMUTATOR DRESSER CO., 1443 Park Ave., Sycamore, Ill. Leaflet descriptive of a low-priced combination portable, tank type cleaner for industrial vacuum cleaning, blowing, and spraying.

Welding Machines

IDEAL ELECTRIC & MFG. CO., Mansfield, Ohio. Booklet describing in detail the Noel "Speed Arc" welder, the outstanding features of which are high power factor, high efficiency, and high speed.

Belting

GATES RUBBER CO., Denver, Colo. Ninety-six page belt guide, covering belts for refrigerators, air conditioners, washing machines, oil burners, woodworking machines, and other light machinery.

Potentiometer Pyrometers

BROWN INSTRUMENT CO., Philadelphia, Pa. Folder illustrating and briefly describing the advantages of Brown potentiometer pyrometers for indicating, recording, and controlling temperatures.

Industrial Thermometers

H-B INSTRUMENT CO., INC., 2518 N. Broad St., Philadelphia, Pa. Bulletin 600, describing the H-B line of industrial dial type indicating thermometers for recording temperature and humidity.

Mixing Machines

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio. Catalogue descriptive of Patterson Type E mixers for paint, varnish, ceramics, rubber, textiles, and chemical and process work.

Tube-Benders

PARKER APPLIANCE CO., Cleveland, Ohio. Bulletin 39, descriptive of Parker tube-benders for production work. The bulletin contains instructions for using this equipment and price lists.

Cut Tacks and Nails

REPUBLIC STEEL CORPORATION, Massillon, Ohio. Booklet containing 24 pages of illustrations and data on the complete line of cut tacks and nails made by this company.

Stainless Steels

FIRTH-STERLING STEEL CO., McKeesport, Pa. Bulletin giving the physical properties, characteristics, working data, and applications of Sterling Nirosta steels.

Mallets and Mauls

LIGNUM-VITAE WOODTURNING CO., INC., 96 Boyd Ave., Jersey City, N. J. Leaflet listing the "Long Life" line of mallets and mauls manufactured by this company.

Chucks

SJOGREN MFG. CO., 1637 E. Slauson Ave., Los Angeles, Calif. Circular descriptive of a collet chuck known as the "Sjogren speed chuck" because of its quick action.

Steels

REPUBLIC STEEL CORPORATION, Massillon, Ohio. Revised list of S A E official steel specifications, giving the chemical compositions of alloy and carbon steels.

Speed Reducers

AJAX FLEXIBLE COUPLING CO., 12 English St., Westfield, N. Y. Bulletin containing dimensions, ratings, and prices of the Lectrigear line of speed reducers.

Colloidal Graphite Lubricants

ACHESON COLLOIDS CORPORATION, 2015 Washington Ave., Port Huron, Mich. Technical Bulletin 40.1, discussing the subject of foreign bodies in oil.

Material-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Circular G-135, illustrating various applications of Cleveland tramrail overhead handling equipment.

Diamond Tools

KOEBEL DIAMOND TOOL CO., 1222 Oakman Blvd., Detroit, Mich. Leaflet outlining the advantages of Koebel diamond dressing tools.

Paint

U. S. GUTTA PERCHA PAINT CO., Providence, R. I. Circular on "Barreled Sunlight," a white paint for plant interiors.

Steel Shafting

BLISS & LAUGHLIN, INC., Harvey, Ill. Circular containing data on BL cold-finished shafting for precision applications.

Turret Lathes

INTERNATIONAL MACHINE TOOL CO., Indianapolis, Ind. Circular descriptive of the Libby "Uni-Flex," a general-purpose turret lathe.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Baker Hydraulic-feed Machine Equipped for Multiple Boring, Reaming, and Chamfering of Cylinder Blocks

Baker Vertical Hydraulic-Feed Machine

An oil-pump of new design provides unusually fast traverse speeds and one or two rates of feed in the automatic cycle of a hydraulically operated machine of vertical design recently developed by Baker Bros., Inc., Toledo, Ohio. This machine is intended primarily for operations on automobile cylinder blocks. One of these machines is shown in the illustration tooled up for second-boring and reaming operations on the valve guide holes of a six-cylinder block and for finish-boring the valve throats and chamfering the valve seats of the same block.

The automatic cycle of this machine is started by depressing one of the foot-treadles. It consists of a rapid traverse of the multiple-spindle head to the work, a coarse feed for the second-boring and reaming of the valve guide holes, an automatic change to a finer feed until a positive stop is reached, a dwell of predetermined length for the chamfering, and an automatic return of the head to its starting position. These movements are controlled by a valve in the hydraulic pump. Adjustable trip-dogs on the side of the saddle gib actuate this valve through a "rapid-fire" box. The hydraulic pumping equipment is contained in the main frame and is provided with a self-contained motor drive.

The machine is designed to accommodate multiple-spindle heads of large size, the saddle on which the head bracket is mounted being 40 inches long. Power for driving the spindles of the machine illustrated is supplied by a motor which is mounted on the head bracket and is directly coupled to the main drive-shaft of the head. However, pick-off gears can be supplied in a unit mounted on top of the column to give a selection of speeds for the main vertical drive shaft. All spindles of the head are mounted in ball bearings and are adjustable vertically. There are twenty-four spindles arranged in two rows, on the machine shown in the illustration.

The table is of a two-station hand-indexed construction, and is equipped with a fixture arranged for chucking two cylinder blocks at a time. The table and fixture assemblies are mounted on a ball to facilitate indexing. The index plunger and the seating of the table on the ball are con'rolled by means of the second foot-treadle at the base of the machine. The cylinder blocks are located in the fixture by means of two dowel-pins of the disappearing type, which are controlled by a lever at the side of the fixture. Two clamps, one at each end of the fixture, hold the cylinder blocks in place.

This machine has been installed in a line of machine tools arranged to produce thirty cylinder blocks an hour.

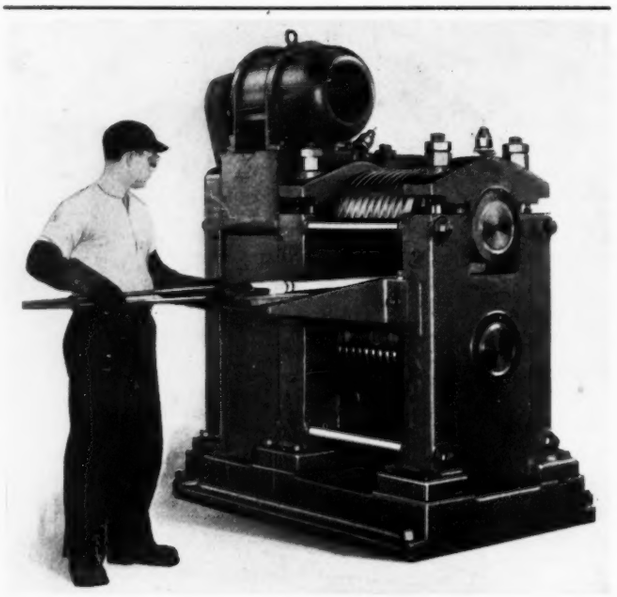


Fig. 1. Ajax Forging Rolls which have a Wide Adjustment without Disengagement of the Gears

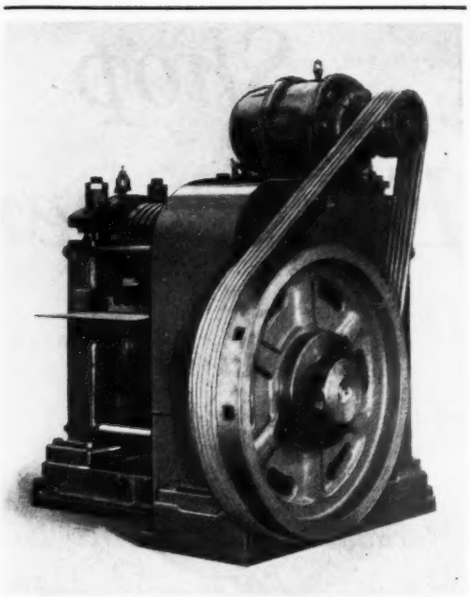


Fig. 2. V-belts Transmit the Power from the Motor to the Flywheel

Ajax Wide-Adjustment Forging Rolls

Forging rolls with an unusually wide adjustment between the semi-cylindrical dies in which the forging impressions are sunk have been developed by the Ajax Mfg. Co., Cleveland, Ohio, to replace earlier models. The wide adjustment feature makes possible a greater number of die redressings, results in longer die life, and decreases die maintenance. Through a novel gearing arrangement, adjustments from 2 1/4 to 4 inches are made without disturbing the meshing of the roll gears, as contrasted with the old arrangement in which long-tooth roll pinions were moved into and out of mesh to obtain adjustments from 3/8 to 3/4 inch.

The new rolls are built in three sizes. The No. 0 or smallest size is used extensively in the automotive field for tapering the ends of spring leaves and for pointing coil springs. The larger Nos. 1 and 2 machines are used for forging gear-shift levers, rear-axle drive shafts, and similar parts, as well as for fullering and drawing operations on stock prior to drop or upset forging.

These forging rolls are built with a lead adjustment on the top-roll die to facilitate correct matching of intricate or shouldered impressions. The top-roll housings are readily adjustable vertically to obtain the proper forging thickness. Like the main housings, they are steel castings with a large cross-sectional area, insuring rigidity. There are provisions for taking up end play of the roll shafts, so as to prevent transverse mismatching of dies. The roll shafts are equipped with integral die-holders in which the die screws are so located as to make possible the use of half-width dies.

The gearing is completely guarded to protect it from scale and other foreign matter. All gear teeth are machine-cut. Plain bearings of shafts are Alemite grease-lubricated and those of the roll shafts are fitted with constant-feed pressure cups.

A motor mounted on an adjustable hinged bracket above the gear housing drives the flywheel through multiple V-belts. The flywheel of continuous-operating machines has a friction-slip member in the hub which acts as a safety device in case stock is misplaced in the rolls.

The larger sizes of these rolls can be equipped for stop-motion operation with the air clutch and co-acting brake which are employed on the Ajax air-clutch forging machines. With this equipment, the operation of the rolls is entirely under the control of the operator, making it possible to use dies with intricate impressions and considerably widening the variety of work that can be roll-forged.

Euclid Hoist with Helical Gears

Helical gears have recently been adopted for the electric hoist that has been manufactured for a number of years by the Euclid-Armington Corporation, Euclid, Ohio. This is believed to be the first time that helical gears have been employed in electric hoist construction. They have been adopted in order to give a quieter, smoother, and stronger drive. Two teeth are always in mesh to withstand shock loads.

Heavy-duty ball bearings are

provided for all shafts of the hoist and a ball-bearing motor is used. The gears and shafts are made of alloy steel, heat-treated and ground. A patented load brake built of alloy steel parts insures safe operation. This brake is of a design that does not require adjustment, and its parts can be easily replaced when worn out. A cam-controlled disk brake stops the motor instantly.

Chambersburg Steam Drop-Hammers

Four steam drop-hammers of 12,000 pounds capacity are being completed by the Chambersburg Engineering Co., Chambersburg, Pa., for the Buick Motor Co. These machines are unusually heavy, weighing over 400,000 pounds apiece. The frames, for example, are believed to be heavier than any ever before used on this type of hammer. From the illustration it will be seen that the base of the frame is extended along the sides of the anvil in a manner that prevents twisting.

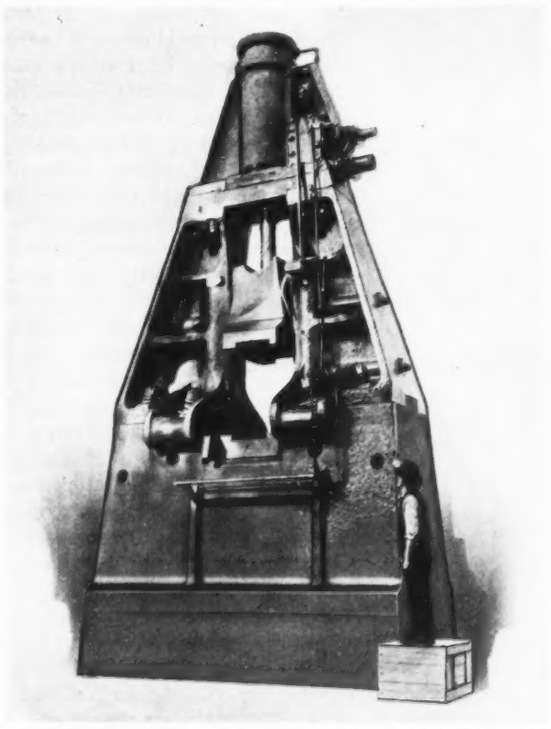
The cylinder is made of Cecolloy, a nickel molybdenum alloy. The cylinder and the new type of balanced slide valve provided are said to give the correct speed at the moment of impact, with a quick pick-up after the blow. Considerable savings in steam or air are obtained from this construction. The slide valve makes possible a reduction in the size of the cylinder bore, a shorter idling stroke, and eliminates valve leakage.

The ram of these hammers measures 42 inches from front to back, while the distance between the guides is 32 inches. The stroke is 51 inches. These hammers will be used for forging crankshafts.

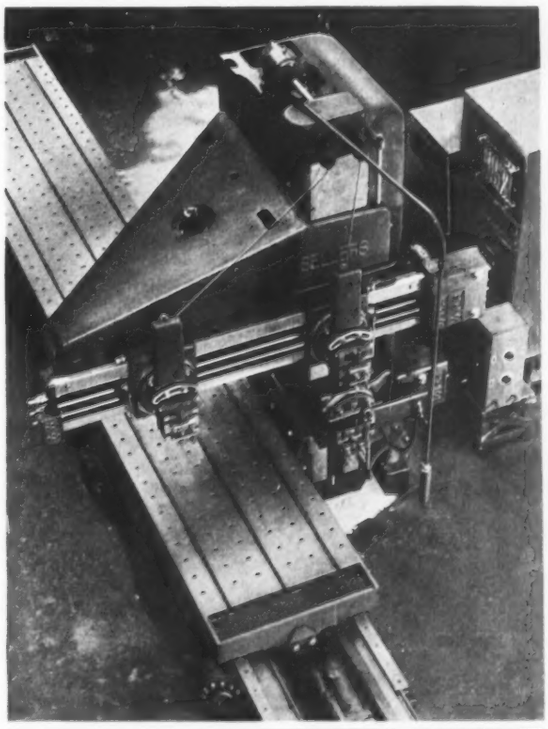
Sellers Completely Electrified Open-Side Planer

Individual motor drives for the various units and automatic electrical control devices are features of a 60-inch open-side planer recently built by William Sellers & Co., Inc., 1602 Hamilton St., Philadelphia, Pa. Separate motors are provided for each head, the platen, the rail elevating mechanism, the rail clamping equipment, and the lubricant pump. There are no operating levers on this machine, except those required for hand motions, all controls being effected through built-in push-buttons and switches. The electrical equipment was supplied by the Westinghouse Electric & Mfg. Co. In all, there are seven motors on the machine.

This planer has a capacity of 60 by 60 inches by 30 feet. The driving motor has a 10 to 1 speed range, which provides cutting speeds from 20 to 200 feet a minute. Limit switches effect automatic reversal without the



Chambersburg 12,000-pound Drop-hammer for Forging Automobile Crankshafts



Sellers Planer with Individual Motors and Electrical Controls for All Units

necessity of shifting levers or other mechanisms. The drive is delivered from the motor to the table through a spiral pinion, a rack, and one pair of helical gears. The thrust on the drive shaft is taken by anti-friction bearings, so arranged that changes in temperature will not affect the adjustment.

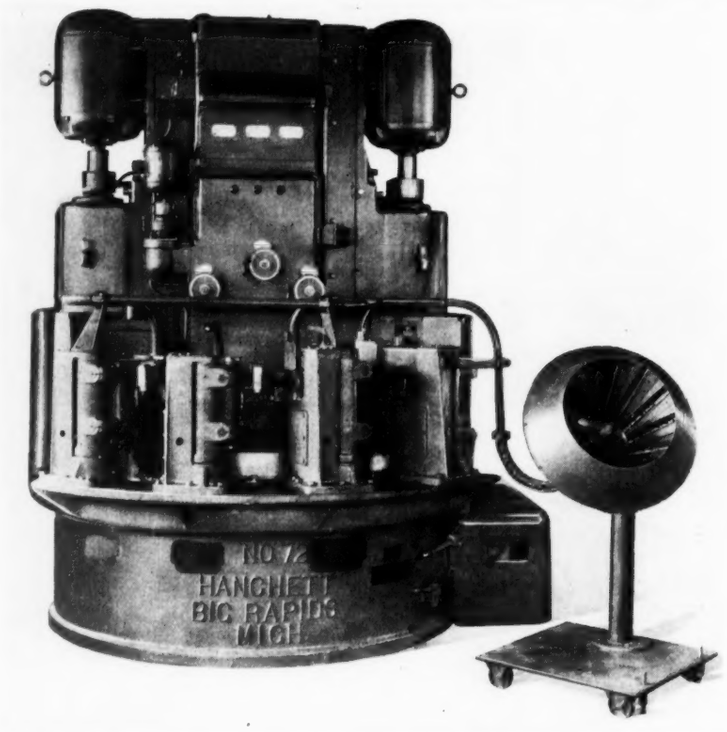
The housing is of the same width and depth all the way to the top, thus insuring rigidity when the cross-rail is in the higher positions. The face on which the side head travels is 21 inches wide, and the depth of the housing from front to back is 79 inches. The cross-rail is made in two pieces—the rail on which the heads travel, and a rear brace that supports the rail. The brace is of welded steel construction, which provides maximum rigidity and strength with minimum weight. Clamps operated by a torque motor through a toggle mechanism hold the rail rigidly to the housing.

All heads are equipped with electrically operated tool-lifters, built into the slides. The lifters are operated from the limit switches that reverse the table and they can be engaged or disengaged by small tumbler switches in the rheostat panel. These electrical tool-lifters eliminate the levers, racks, pinions, etc., required in mechanical tool-lifters.

Perhaps the most unusual feature of the machine is the simplified feed and traverse mechanism provided for each head by the use of individual motors. The entire mechanical part of the drive to each head consists of a worm, a worm-wheel, and a pair of spur gears that connect the motor to the screw and splined shaft. The electrical parts include a measuring relay, two magnetic clutches, two elevator car switches for the feed, and the necessary push-buttons for the traverse. Any head can be traversed while the others are being fed.

Hanchett Automatic Rotary Surface Grinder

Loading, clamping, grinding, and unloading of the work pieces, as well as turning the pieces end for end during the operation, are all accomplished automatically on the rotary surface grinder illustrated, which was recently built by the Hanchett Mfg. Co., Big Rapids, Mich. This machine is equipped for grinding a cylindrical part 1 inch in diameter by 1 3/4 inches long. The ends of the part must be ground parallel to within 0.001 inch and square within 0.0004 inch. Approximately 0.040 inch of stock is removed from each end.



Hanchett Rotary Surface Grinder which Automatically Finishes Cylindrical Parts to Length within Close Limits

When the pieces come to this machine, they have already been ground to within 0.001 inch of the finished diameter by a Cincinnati centerless grinder. The parts are shoveled into the Danly hopper feed at the right of the machine, and this device feeds them upward through a tube into a swinging arm which loads the pieces into the successive stations of the fixture. The fixture is mounted on the rotating table and has eighty-four stations, each of which is provided with an automatic clamping arrangement. The pieces are fed into the stations with the fixture in motion.

In operation, each piece is passed beneath three grinding wheels as the fixture revolves in a counter-clockwise direction. As the piece reaches the first ejector mechanism, seen at the extreme left, it is ejected upward through a tube and passed horizontally to a second loading device adjacent to the first loader. The second loading device places the piece, which has now been finish-ground on one end, into a station with the opposite end upward. The piece then makes another circuit around the machine, and when it reaches the second ejector mechanism it is ejected from the machine through

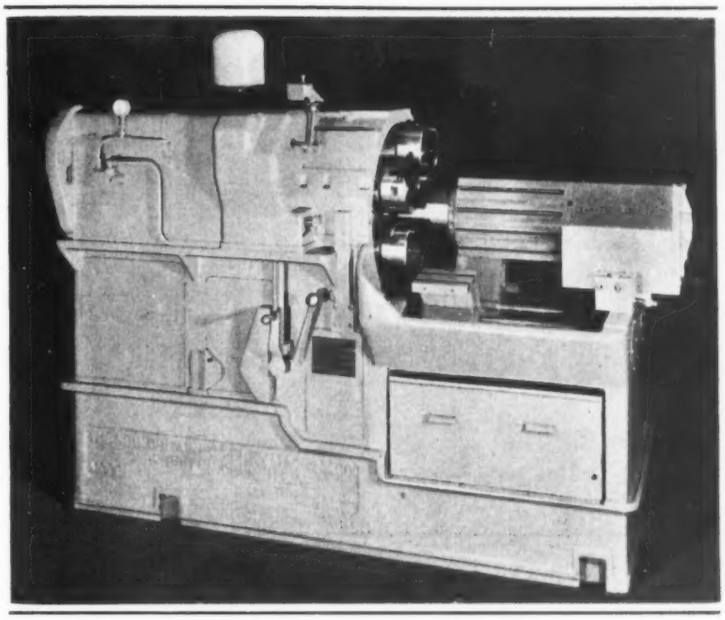
another tube and into the work container that is provided.

The production rate is 35 complete pieces, or 70 surfaces, a minute. Table speeds from 3/4 to 4 revolutions per minute are available. The three vertical grinding-wheel heads are each equipped with a 20-inch cylinder wheel and driven by an individual 25-horsepower motor. There is an automatic sizing control for each wheel, which compensates for wheel wear and gages the size of the work. The three wheels are of different grain sizes, so as to obtain both large stock removal and a fine finish.

Houghton Straight Cutting Oils

Considerable time has recently been spent by the Research Laboratory of E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa., in studying the subject of cutting oils with the view of determining modern requirements, taking into consideration costs, new alloys, high-speed machines, and mass production. A high degree of heat absorption and an enduring film of oil on the tool were found to be the most desirable properties. The cutting oil should be so fluid that it will penetrate quickly in back of the cutting edge of the tool as the cut proceeds at high speed, but at the same time, it should have a sufficiently high film strength to withstand the heavy pressures exerted on the tool. Because cutting oil is used over and over again, the physical and chemical properties should remain the same over long periods of time.

All of these qualities are available in a new series of straight cutting oils being placed on the market by the concern as the result of this investigation. The new series includes Super Refrigerant Base and Frapol, Nos. 414 and 418. It is stated that these cutting oils will withstand full loads on standard Almen or Timken testing machines without failure, thus meeting the requirements of film strength.



New Britain-Gridley Chucking Machine with New Design Features

New Britain-Gridley Multiple-Spindle Chucking Machine

The spindle-carrier of a No. 16 multiple-spindle chucking machine developed by the New Britain-Gridley Machine Co., New Britain, Conn., is so designed that it does not touch the frame or housing of the machine during indexing movements. In the indexed or working positions, the spindle-carrier is clamped down on two opposed locating pads, but during indexing, the carrier clears these pads by several thousandths of an inch. This construction eliminates wear on the spindle-carrier or on its supporting surfaces, thus maintaining tool and spindle alignment. Indexing is accomplished in 1 1/2 seconds by a Geneva motion.

All six spindles are mounted in preloaded ball bearings and are equipped with hydraulic chucks operated by individual oil cylinders. There is a direct drive to the spindles in the working positions through a silent chain 3 inches in width. As each spindle indexes into the loading station, it is automatically disengaged from the chain. A hydraulic device insures the proper tension on the chain at all times.

The spindle-carrier is pressed and keyed on one end of the 8-inch diameter tool-slide stem. The pulling action on this slide is applied in the center, so as to avoid any cramping action. The guide for the tool-slide is made unusually rigid and is designed to exclude all chips. Tools and toolholders can readily be applied to the slide, and an end-plate assembly can be furnished for rotating tools as in tapping and threading.

Swinging tool-holders actuated by radial cams are provided for forming and similar operations. In addition, auxiliary slides can be attached to the spindle-carrier housing for facing, forming, accelerated boring or turning, and shaving. Reaming, boring, or turning slides can also be mounted on the main tool-slide.

All moving parts of the machine are submerged in oil or sprayed with oil. There are no individual leads or hand-filled cups. This machine will swing work up to 9 1/4 inches in diameter. It can be operated at spindle speeds from 27 to 338 revolutions per minute.

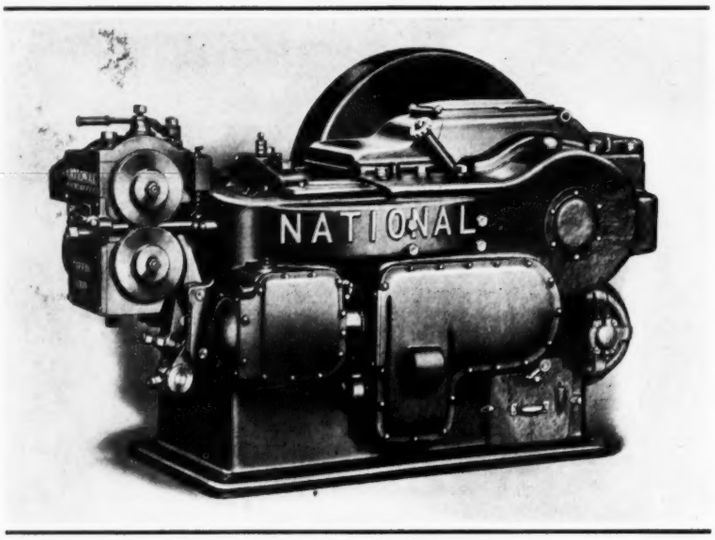


Fig. 1. Open-die Cold-heading Machine Recently Developed by the National Machinery Co.

National Single- and Double-Stroke Open-Die Cold-Headers

A line of open-die cold-heading machines has been developed by the National Machinery Co., Tiffin, Ohio, in a complete range of sizes. These machines are similar in design and method of operation to the solid-die machines described in May, 1934, MACHINERY, page 565. However, the addition of a relieving-grip motion enables the machines to operate either as relieving-grip or solid-die machines. This provides unusual versatility in the kind and range of work that can be handled. The machines will produce long or short open- or solid-die work with equal facility. All work can be extruded simultaneously with the heading operation to prepare it for roll-threading.

Fig. 2 shows the die box arranged with open or two-piece dies. The wire is fed through a shearing bushing, cut off, carried over, and pushed back into the die, the same as in a solid-die machine. At the time of heading, the dies are rigidly held together by the gripping mechanism, but as soon as the heading is completed, and before the "kicking" starts, the grip is slightly relieved. The blank, consequently, is easily ejected from the dies, regardless of its length. The gripping mechanism is toggle-operated and is protected by an automatic relief.

One of the important advantages of this construction is that it is only necessary to change the stroke of the wire feed and adjust the position of the knock-out pin in order to permit forgings of any length to be produced in the same die. This greatly reduces die investment, because it is unnecessary to have a separate die for each length of bolt. In addition, die life is increased and parts can be produced with central heads, with the shanks accurate and uniform under the heads, and practically without any parting line.

In Fig. 3, the die box is shown equipped with an adapter that enables solid dies to be used. When solid dies are used, the gripping mechanism is locked to hold the die rigidly in alignment. Locking of the die is accomplished by means of a screw on top of the machine.

The machine can also be operated with split dies, clamped solid, for heading extremely long pieces. If trouble is encountered in ejecting the work, the grip-actuating screw can be opened to permit the machine to operate as an open-die header, and thus relieve the pressure on the work prior to ejection.

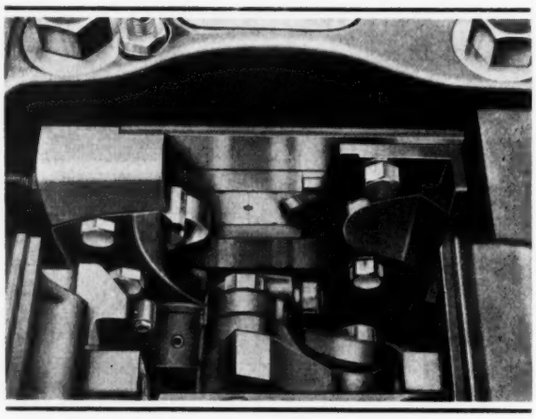


Fig. 2. Die Box Set up with Open or Two-piece Dies

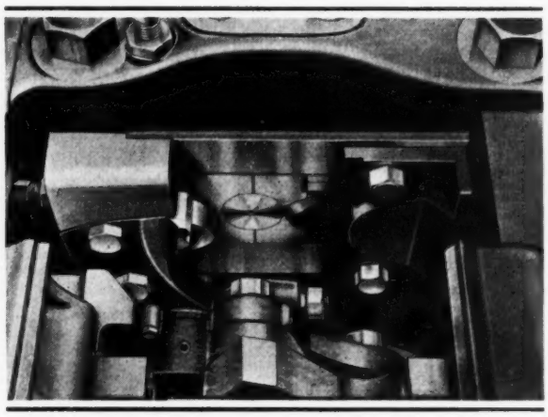


Fig. 3. Die Box Provided with an Adapter for Solid Dies

Newark Gear-Tester

Worms and worm-wheels from the smallest up to pairs having a center distance of 38 inches can be handled with the testing equipment here shown, which was recently developed by the Newark Gear Cutting Machine Co., Inc., 69 Prospect St., Newark, N. J. Worms up to 16 inches in diameter can be accommodated. Helical and spur gear sets with a minimum center distance of 5 inches can also be accommodated by means of a simple adapter. The machine is designed to check center distance, tooth bearing, and running smoothness. It will test all gears that come within the range of the Newark No. 5 hobber or machines of similar capacity.

Figs. 1 and 2 illustrate the range of the machine for large and small work, while Fig. 3 shows two pump rotors being tested in the manner employed for helical gears. The cross-slide is operated by a handwheel equipped with a micrometer dial, and there is a fixed scale on the cross-slide, which facilitates accurate determination of center distances. The gear support provided on the cross-slide can be provided with an adapter, as shown, to accommodate worm-gears of the ring type.

The knee, which is provided with headstocks for supporting worms, is adjustable vertically by turning a handwheel to actuate an elevating screw. Both headstocks have 5-inch diameter holes, into which bushings can be fitted to suit the work. Centers are provided to support solid worms up to 38 inches long or hollow worms on arbors.

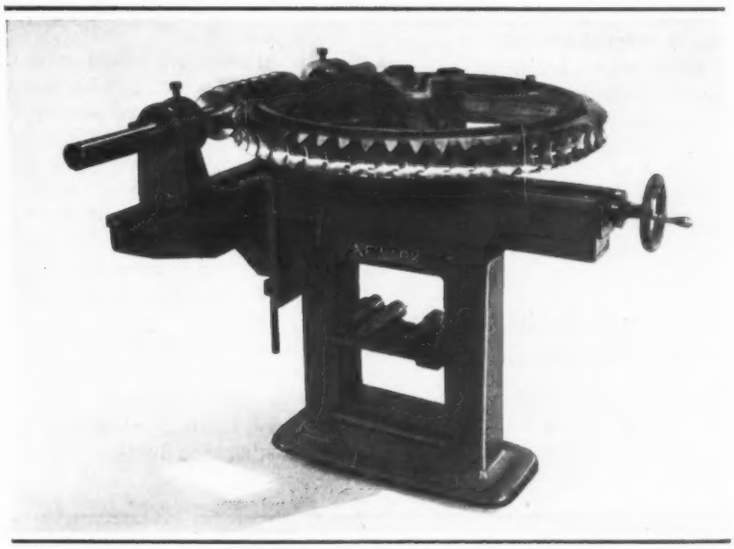


Fig. 1. Newark Gear-tester being Used for Checking a Worm and Worm-wheel of Large Dimensions

Goodyear Transmission Belts

A patented vulcanized splice has been developed for Compass Cord transmission belting made by the Goodyear Tire & Rubber Co., Akron, Ohio, by means of which belts can be made endless as they are being installed. This development enables belt users to obtain the belting in roll lots for use on drives where it was formerly necessary to dismantle pulleys in order to install an endless belt.

With the new splice, the ends of the belt are joined by dovetailing the load-carrying core of cords and then vulcanizing the splice with a portable outfit developed for this purpose. The

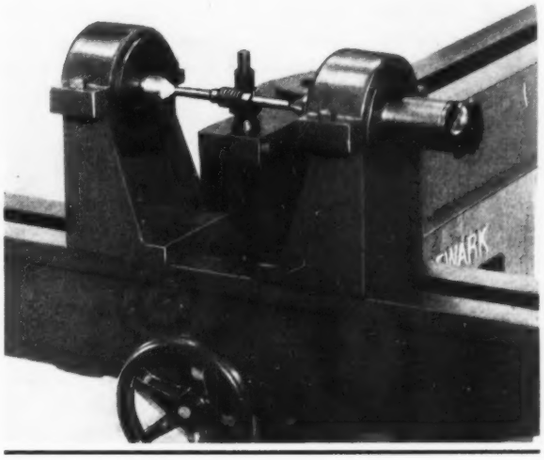


Fig. 2. Testing a Small Set of Worm-gearing

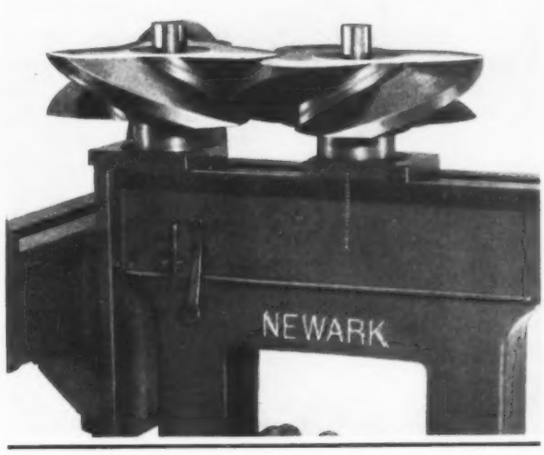


Fig. 3. Checking a Pair of Helical Pump Rotors

belt is so constructed that the load is carried entirely by a layer of cords embedded in rubber and sheathed in a protecting fabric envelope.

The concern will continue to manufacture Compass Cord endless belts for drives where endless belts can be installed without difficulty.

Mercury Gasoline Tractor with Pneumatic Tires

Large pneumatic tires are provided at the front and rear of a Type D gasoline-driven industrial tractor recently brought out by the Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill. Dual tires are furnished at the rear, as shown in the illustration. The pneumatic tires provide increased traction and a cushioning effect for the tractor mechanism, which are especially important for tractor operation over the rough roadways, upgrades, etc., of industrial plants.

The tractor is of unusually compact design and has a short turning radius. The over-all length is only 86 inches, and the width 60 inches. The outside turning radius of the equipment is 115 inches.

Mercury Pneumatic-tired Gasoline-driven Industrial Tractor

S-B Speed Reduction Units

Speed reducers based upon the principle of a patented gyrating gear are being introduced on the market by the Sier-Bath Co., 640 W. 58th St., New York City. These gyrating-gear reducers are built for ratios of 20 to 1 and greater. When the speed reduction is between 4 to 1 and 20 to 1, planetary gearing is employed.

One of the important advantages derived from the use of a gyrating gear is that ratios up to 180 to 1 can be obtained with only a single reduction. It also permits an unusually compact design, the diameter of the reduction unit being made the same as that of a standard N.E.M.A. motor of the same horsepower rating. Gear ratios up to 14,400 to 1 can be obtained with a double stage of gearing and up to 1,728,000 to 1 with a triple stage.

In a gyrating type of reducer of 1 horsepower rating or less, the construction is as shown in Fig. 2. The high-speed pinion *A* drives three intermediate gears *B* which have integral eccentrics. These eccentrics support the gyrating gear *C*, which meshes with a fixed internal gear *D*. The rotation of the eccentrics causes the gyrating gear to roll along the teeth of the internal gear.

This rolling motion causes a slow forward rotation of the gyrating gear which for each revolution of the eccentrics is equal to the difference between the number of teeth in the gyrating gear and in the internal gear. This slow rotation of the gyrating gear reacts through the eccentrics so as to revolve the slow-speed output shaft to which the eccentrics are attached. Many different speed ratios can be obtained by varying the throw of the eccentric shafts and the ratio between the high-speed pinion and the intermediate gears.

In reduction units above 1 horsepower, two gyrating gears of the same size are employed, in order to distribute the load over a wider tooth bearing surface. Thirty per cent of the teeth in the gyrating gear are always partly in mesh and at least four are fully in mesh. These reducers range from 1/2 to 50 horsepower capacity and are built in horizontal and vertical models, both plain and motorized. Owing to the high safety factor with

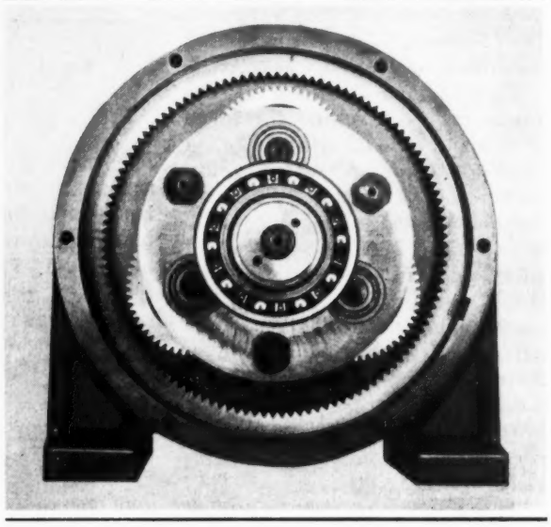


Fig. 1. Gyrating-gear Speed Reducer with End Cover Removed

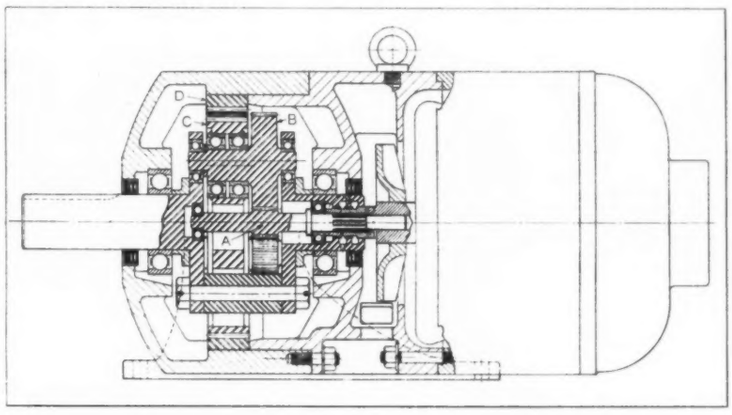


Fig. 2. Speed Reducer of the Single-stage Gyrating-gear Type Built for Ratios up to 180 to 1

which all parts have been designed, these reducers are said to have a very high overload capacity and to be particularly suitable where excessive shock service is encountered.

Tests conducted on these speed reducers have shown a high efficiency with respect to horsepower input and output. For example, a speed reducer with an input of 1.12 horsepower running at an input speed of 1800 revolutions per minute and having an output speed of 15 revolutions per minute, delivers 1.025 horsepower on the output shaft, thus having an efficiency rating of 91.5 per cent. Accessibility is another important advantage claimed for these reducers. By simply removing one end cover, the entire mechanism, with the exception of the fixed internal gear, can be withdrawn as a unit. This unit can be easily reassembled without alignment difficulties. All parts of the reducer are interchangeable, are made of heat-treated alloy steel, and revolve in New Departure ball bearings. Effective seals are provided to retain the oil within the reducer housing.

Edlund Motor-Driven Drill Units

The line of drilling machines built by the Edlund Machinery Co., Inc., Cortland, N. Y., has been supplemented by hand- and power-feed drill units, equipped with individual motor drives. These units can be mounted vertically, horizontally, or at an angle for drilling holes in different planes. These drill units can be applied in groups.

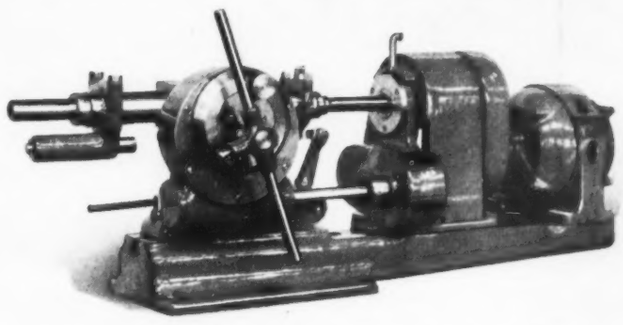
The spindle of these units is driven by the motor through a pair of helical quick-change gears and a broached two-spline quill. On the power-feed unit, which is shown in the illustration, a four-step cone pulley mounted on the quill drives the feed mechanism. In operation, the feed is automatically engaged as the drill advances and comes into contact with the work. A dial gage is provided to determine the depth to which holes are to be drilled. When the predetermined depth has been reached, a stop disengages the feed and the spindle is returned to its starting position. However, the feed can also be disengaged at any time by raising the lever.

The hand-feed unit is the same in appearance as the power-feed model, except that the feed-box and pulleys are omitted.

These units have a capacity for drilling 3/4 inch in steel. Spindle speeds from 360 to 3000 revolutions per minute are available while feeds of 0.002, 0.0035, 0.006, and 0.010 inch per spindle revolution are provided.

Shaler Shaker

A mechanical device for imparting a horizontal shaking or screening motion to conveyors, screens, etc., is being placed on the market by the Ajax Flexible Coupling Co., 12 English St., Westfield, N. Y., under the trade name of "Shaler Shaker." This equipment is intended to replace



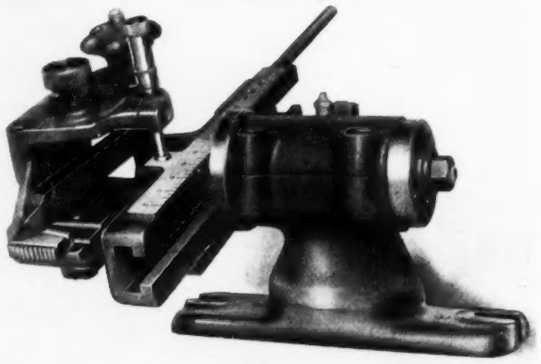
Edlund Motor-driven Drill Unit Built in Hand- and Power-feed Models

A Mechanical Device that Imparts a Shaking Motion

the eccentric drive commonly used for this purpose. Mechanically, the device consists of two weights, so geared together that when one is driven by a pulley, both rotate at the same speed, but in opposite directions. The shaker is used extensively in separating grain, gravel, sand, and other dry materials.

The unit is dust-, oil-, and fire-proof. The weight members operate in a closure, so that dust and grease cannot collect and reduce their effectiveness. The unit can be driven either by belt or direct, and two or more units can be operated in parallel.

The gear housing and inner-bearing support member are cast integral with the central portion of the frame, thus insuring constant alignment of gears and driving shafts. The outer bearing support is cast integral with the end closure member. The inner bearings are full-floating.



Attachment for Grinding the Throat of Collapsible Tap Chasers

Tap-Chaser Throat-Grinding Attachment

An attachment that enables the users of Landis collapsible tap chasers to regrind the throat or chamfer of the chasers has been placed on the market by the Landis Machine Co., Inc., Waynesboro, Pa. It is important that the throat of all the chasers in a set be ground uniformly to the same degree and length. If this is not done, the chasers will not cut uniformly, with the result that a part of the set will take the entire burden of cutting the thread. The new attachment is intended to guard against this condition. The manufacturer points out that the throat on tap chasers should never be ground by hand.

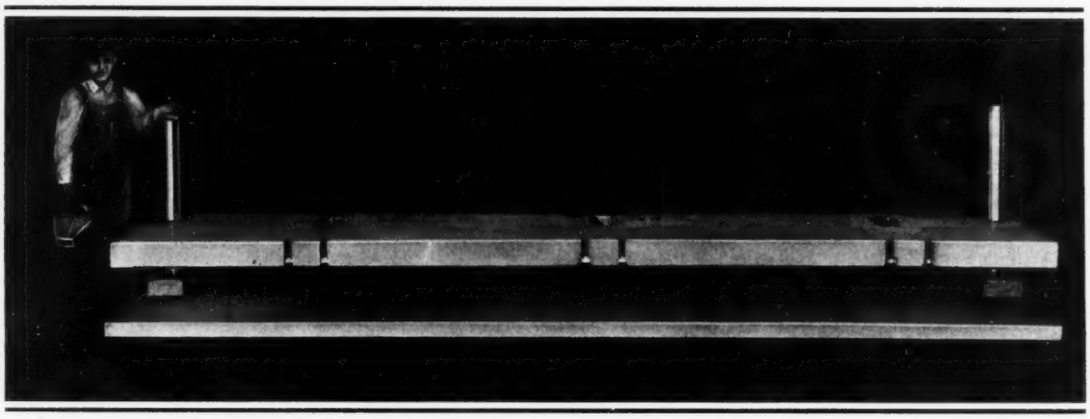
The base of this throat-grinding attachment is designed to be bolted to the table of most standard tool- and cutter-grinding machines. Mounted on this base is a swivel which carries a spindle to which a vise is attached for holding the chasers. The vise is adjustable, so that the chasers can be set to a radius corresponding with that of the thread that they are to cut, and is graduated for diameters from 1 to 13 1/2 inches. There is a micrometer for obtaining the desired amount of radial clearance.

The individual chasers are held by an adjustable clamp and locked by a hand-screw. In operation, the spindle and vise are rotated by means of a handle, so as to provide an oscillating movement for grinding the chaser against the face of a cup-shaped wheel. The attachment is suitable for grinding all sizes of chasers used in Landis Styles LT and LM taps, as well as the chasers used in the Victor collapsible taps previously manufactured by the company, up to and including the 12-inch size.

Danly Die Set of Unusual Size

A die set weighing 10,900 pounds was recently torch-cut from steel plate and welded together by the Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill. This die set is for use in the production of automotive frames. It is 24 inches wide by 16 feet long.

Steel bosses are screwed and doweled in place to carry bronze bushings, 4 inches inside diameter by 10 1/4 inches long. The hardened and ground guide posts



Danly Die Set of Welded-steel Construction which has an Over-all Length of Sixteen Feet

are 4 inches in diameter by 45 inches in length. The shoe and holder are 3 and 5 1/4 inches thick, respectively. The relief provided for the bolt heads in the bolt slots and the cut-outs in the shoe and holder demonstrate the adaptability of the "Torch-Cut and Weld" method to the building of any desired die set or other steel-plate specialty.

Shaper-Vise Attachment for End-Shaping

Long pieces can be conveniently shaped on the ends by the use of an attachment recently brought out by the National Machine Tool Co., Clark St., Racine, Wis., for application to the regular vise of shapers. As will be seen from the illustration, this attachment clears the table of the machine. It consists of two adjustable jaws which are positioned at right angles to the regular vise jaws.

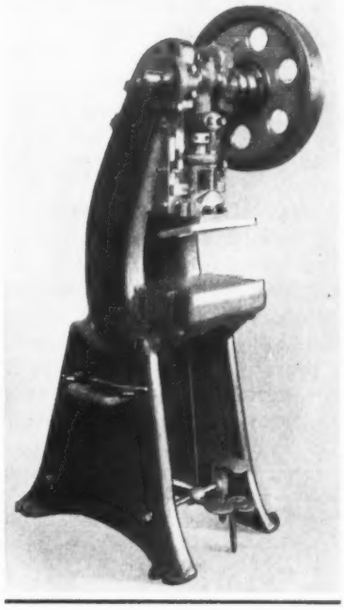
The attachment is arranged for mounting on a shaper vise by first removing one of the vise jaws and then using it as a jig for drilling holes in one of the attachment jaws. Work can be accurately measured by micrometer or vernier calipers without removing it from the attachment.

This concern also makes a shaper vise that is provided with an extra pair of jaws for end-shaping operations.

Attachment that Facilitates End-shaping of Long Pieces

Zeh & Hahnemann Press of Improved Design

Power presses of the Reclinable line built by the Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J., are now supplied with slides having round holes to suit the shanks of punch-holders. Another improvement is that clamping caps of a half-round design are furnished, as may be seen on the machine here illustrated. Strength and better appearance are the advantages claimed for this clamping cap.



Power Press with New Slide and Clamp

The improved presses incorporate such other features as a patented non-repeat clutch; a web type self-lubricating, full-bearing flywheel; 40 degrees of inclination; a treadle-operated loop guard; and a treadle guard.

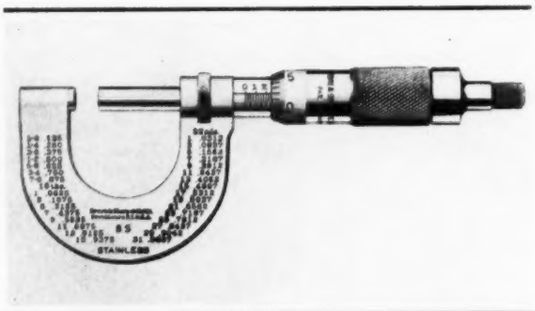
Vacuum Cleaner for Industrial Plants

Industrial vacuum cleaning, blowing, and spraying can all be done with the equipment here illustrated, which is built by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. When this equipment is used as a vacuum cleaner, the accumulations of dirt, dust, scrap, etc., are first drawn into a 12-gallon aluminum-finished steel tank, where the heavy particles are deposited. Then the fine dust and dirt only are drawn into the dustproof bag. This design prevents the heavy materials from passing through the fan and injuring the fan blades. Because the collections of the metal tank can be easily salvaged, this equipment has been found especially advantageous in shops where work is done with expensive and precious metals.

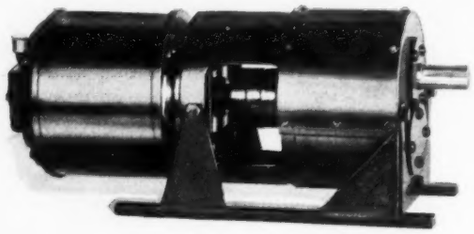
Vacuum-cleaning, Blowing, and Spraying Equipment

The removable motor unit allows for quickly changing over from vacuum cleaning to blowing. In vacuum cleaning, the one-horsepower motor and 7-inch fan create a vacuum of 46 1/2 inches water-lift. When the equipment is used as a blower, it delivers a stream of dry air at the rate of over 25,000 feet a minute.

Standard attachments are available for all ordinary cleaning operations, and special attachments can be supplied for such service as cleaning furnace pipes, boiler tubes, hearths, and ovens of different types. Attachments are also available for spraying paints, lacquers, insecticides, and other liquids. The equipment is also suitable for cleaning automobiles and trucks. It weighs about 40 pounds.



Stainless Steel Gives This B & S Micrometer a Fine Appearance



Lectrigear Speed Reducer Designed for Use with Different Makes of Motors

Brown & Sharpe Micrometer Calipers with Stainless Steel Parts

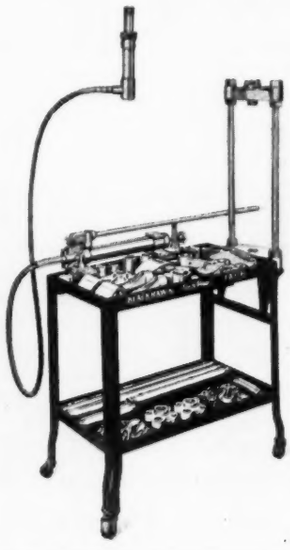
Stainless steel is used for the frame, thimble, barrel and all unhardened parts of a new line of micrometer calipers being placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. The spindle of these micrometers consists of a single piece of hardened high-chromium high-carbon steel with ground threads, the material giving unusual resistance to wear. The same wear-resisting steel is used for the anvil. Larger figures are provided on the thimble, and the figures and graduations on both the barrel and thimble have a non-reflecting background which facilitates reading.

These micrometer calipers are made in a No. 8S size, which measures from 0 to 1 inch in thousandths of an inch, and in a No. 10S size, which measures from 0 to 1 inch in ten-thousandths and thousandths of a inch. Both sizes of these tools can be supplied with or without a ratchet stop.

Portable Hydraulic Power Unit

A portable power unit consisting of a hydraulic jack mounted on a table that can be conveniently wheeled around the shop has been placed on the market by the Blackhawk Mfg. Co., Milwaukee, Wis. The illustration shows the hydraulic pump mounted horizontally on the table, but it can be removed for use under machines, automobiles, etc. The power developed by the pump is delivered through a flexible hose to the ram of the jack. Seven tons of pressure can be applied in any direction by the ram.

Thirty attachments are available, permitting the jack to push, pull, spread, clamp, press, or straighten work. At one end of the table is a vertical stand on which the jack can be mounted for pressing parts into or out of other parts. The stroke of the pump can be regulated within 0.001 inch.



Portable Power Unit for Many Jobs About the Shop

Lectrigear Reduction Units

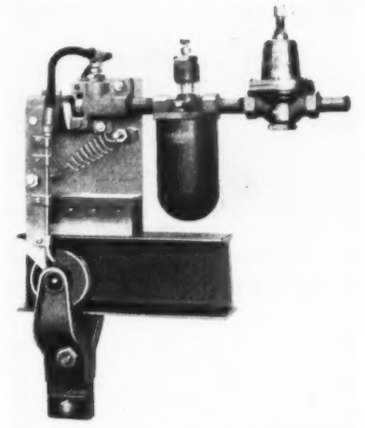
The Ajax Flexible Coupling Co., 12 English St., Westfield, N. Y., has brought out a helical-gear reduction unit called the Lectrigear. This unit is manufactured in sizes ranging from 1/8 to 2 horsepower. It is designed to meet three needs, as it can be furnished equipped with a motor ready for use, without a motor to manufacturers who prefer to supply one themselves, and without a motor to motor manufacturers who would like to place gear-motors on the market.

Footless or flange type motors can be applied without changing shafts or bearings by the use of a simple adapter ring. Standard motors of various makes can be used. When the unit is supplied without a motor, the customer can install one in a few minutes.

Pneumatic Overhead Trolley Lubricator

A pneumatic device for lubricating the bearings of trolleys on overhead conveyors is being placed on the market by the J. N. Fauver Co., Inc., 91 Selden St., Detroit, Mich. This lubricator was designed by F. Bjerre, a Detroit engineer.

With this device, the plant air pressure is reduced by a Norgren valve. The air is then passed through a Norgren air-line lubricator which introduces lubricating oil of the proper viscosity to the air steam, a drop at a time. A fog of oil leaves the air-line



Automatic Device for Lubricating Trolleys of Overhead Conveyors

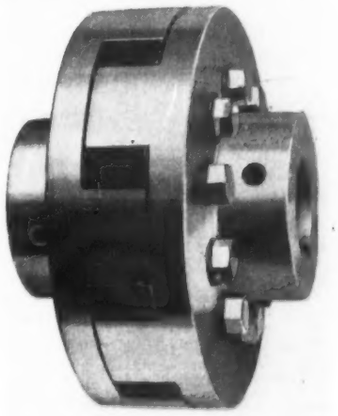
lubricator and is applied under air pressure to the trolley bearings.

This occurs as each trolley passes under the lubricator and trips a pair of triggers. The lubricator is built up of cold-rolled steel and is attached by means of machine screws to the top of the conveyor rail. The air pressure, volume of oil, and direction of the jet are readily adjustable. The device has an oil storage capacity of 1 1/2 pints.

Flexible Coupling with Free-Floating Load Cushions

Flexible couplings having individual free-floating load cushions hung on removable studs between steel or iron jaws have been added to the L-R line of tools manufactured by the Lovejoy Tool Works, 5021 W. Lake St., Chicago, Ill. These Type P couplings are available for shaft diameters from 3 to 10 inches. Cushions can be supplied made from Metalflex, leather, or Multiflex.

Metalflex is a long-wearing brake-lining material. Cushions of this material are supplied when couplings are to be used for heavy shock loads, such as are encountered in the operation of excavating machinery, steel-mill equipment, etc. Cushions of the same material are also provided when the coupling is to be exposed to extreme weather conditions. Cushions of oak-tanned belting leather are furnished on couplings that are used for carrying sustained loads and that take care of a large amount of misalignment. Multiflex is a rubber-duck fabric that is vulcanized under pressure. Cushions of this material are furnished on couplings used for fluctuating loads



L-R Flexible Coupling with Individual Load Cushions

and conditions where a high resilience is required.

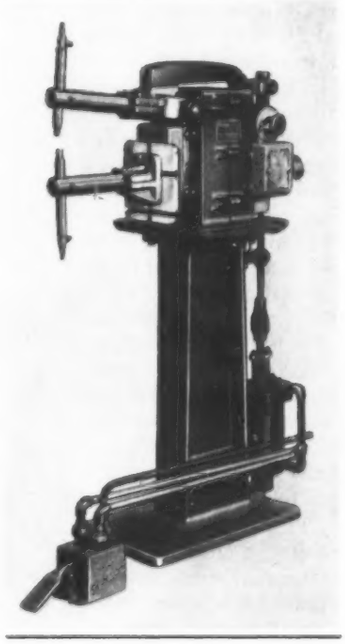
The load cushions are always in sight for convenient inspection. They can be removed and replaced within a few minutes when necessary. In operation, half of the cushions are idlers, except in reversing a load; hence there is always a set of new cushions available in the coupling. This feature eliminates shutdowns, because worn cushions can be replaced at any time when the driven machines are not in productive operation, so as to provide another set that will be new when the cushions in use need replacement. There is no wear on the iron or steel jaws of these couplings, and no lubrication is necessary.

Eisler Air-Operated Spot-Welders

Electric spot-welders in which air pressure is utilized for closing the electrodes on the work have been added to the lines of foot-operated and motor-driven welders manufactured by the Eisler Engineering Co., Inc., 752 S. 13th St., Newark, N. J. These welders are available in sizes from 5 to 75 kilovolt-amperes for welding metal up to 0.75 inch in thickness. Because of the air cylinder design, the machine consumes only a small amount of air. Air pressures up to 80 pounds per square inch are used, the pressure depending on the size of the machine.

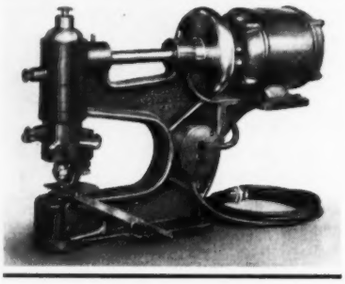
When the operator depresses the foot-pedal of the valve on the floor in front of the machine, air from the supply line is admitted into the cylinder at the back of the machine. The pressure of the air on the piston then imparts motion to the upper electrode through a vertical shaft.

In addition to relieving the operator from supplying the force required to bring the electrodes together, the air equip-



Eisler Spot-welder with Air-operated Upper Electrode

ment, by means of a valve in the supply line, permits close regulation of the electrode pressure on the work. This is an essential factor in the making of uniform welds.



Motor-driven Small-sized Nibbler

Savage Motor-Driven Nibbler of Small Size

The latest addition to the line of nibbling machines built by the W. J. Savage Co., Inc., Knoxville, Tenn., is a power-driven model with a throat depth of 9 inches. This No. 109 machine has a capacity for nibbling 1/8-inch mild steel or 1/16-inch tough alloy steel. It will operate at a feeding rate of from 36 to 60 inches a minute.

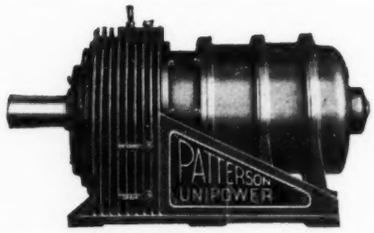
The machine is direct-driven by a 1/4-horsepower motor. Except for the cutting tool, there are no moving parts at the front. The machine is equipped with a patented toolholder assembly, a revolving head, adjustable tools and dies, and an adjustable ram bushing. Both templet and line-cutting can be done with this equipment. It has a weight of 125 pounds.

This model supplements a line of nibbling machines that includes machines with throat depths up to 36 inches and capacities for nibbling plate up to 3/4 inch thick.

Horizontal Unipower Speed Reducers

Speed reducers of horizontal design have been added to the gearless Unipower line built by the Patterson Foundry & Machine Co., East Liverpool, Ohio. Sizes from 1/4 to 100 horsepower and all speeds are included. The units are so designed that any motor of standard frame size can be installed in the field. The output shaft is on the same center as the motor shaft.

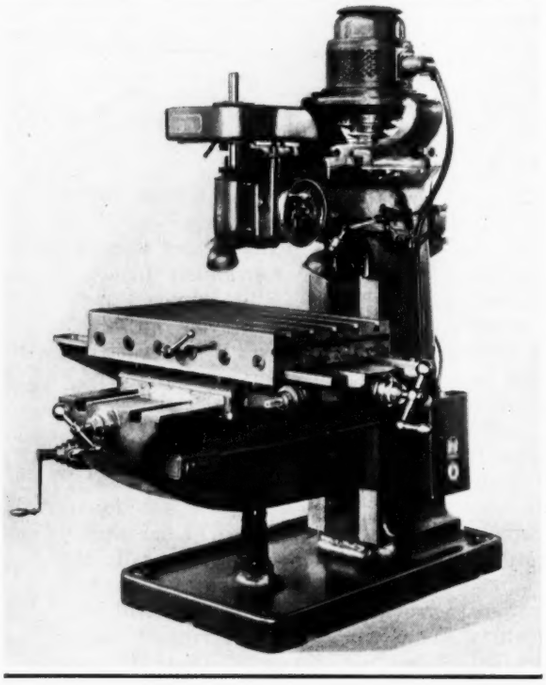
These units are designed for driving a wide variety of slow-moving machinery, conveyors, elevators, brewing and distilling apparatus, etc. They occupy a minimum floor space.



Unipower Gearless Speed Reducer

Reed-Prentice Vertical Milling and Die-Sinking Machine

A vertical milling and die-sinking machine designed especially for rubber-mold and metal-pattern work has been placed on the market by the Reed-Prentice Corporation, Worcester, Mass. This Model 3VS machine is equipped with hand longitudinal and cross feeds. Both screws for these feeds are furnished with adjusting nuts. The table and saddle are mounted on roller bearings that are carried in eccentric holders to provide for proper adjustment. Hardened steel ways are furnished on the knee and saddle. The rollers are lubricated by the Alemite system. Slots on the ends of the table permit the clamping of extra long plates.



Reed-Prentice Machine Designed for Finishing Molds and Metal Patterns

Ten spindle speeds ranging from 400 to 2600 revolutions per minute are available with a motor running at 1200 revolutions per minute. A nut provides for locking the spindle when collets and cutters are to be removed. The under side of the throat is cut out to accommodate a lamp in addition to the bracket lamp shown. As on the standard Model 3V machine, a push-button control with a magnetic switch and plugging relay provides for quick stopping of the spindle.

The machine has a longitudinal feed of 27 inches, a cross-feed of 20 inches, and a ver-

tical knee feed of 16 inches. The table is 32 inches long by 22 inches wide. The maximum distance from the spindle to the table is 16 1/2 inches, and the throat depth is 22 inches.

* * *

Boye & Emmes Co. Celebrates Fortieth Anniversary

It is just forty years ago that a partnership was formed in Cincinnati under the name of Dietz, Schumacher & Co. for the purpose of manufacturing engine lathes. This company is known at present as the Boye & Emmes Machine Tool Co. A year after its inception, F. W. Boye, Jr., entered the partnership, and the name of the concern was changed to Dietz, Schumacher & Boye. In 1900, Mr. Dietz retired, and the name was again changed to Schumacher & Boye.

In 1912, Mr. Boye purchased Mr. Schumacher's interest, and the company was incorporated under the name of the Boye & Emmes Machine Tool Co., Mr. Emmes having been the superintendent of the plant for some twelve years prior to that time. Mr. Emmes passed away in 1928, but the company continues under its incorporate name with F. W. Boye, Jr., still actively directing the business, after having done so for nearly forty years.

The company has continued to build engine lathes as its only product throughout this period. A great many thousands of its machines are in use, not only in the United States, but throughout the world. The company's present plant on Caldwell Drive in Hartwell, a suburb of Cincinnati, was built in 1930 and is of the most modern construction. The commercial policy of the company has been to sell through dealers located in all the principal cities in the country, with the Bryant Machinery & Engineering Co., of Chicago, as its general distributor in charge of the direction of sales.

* * *

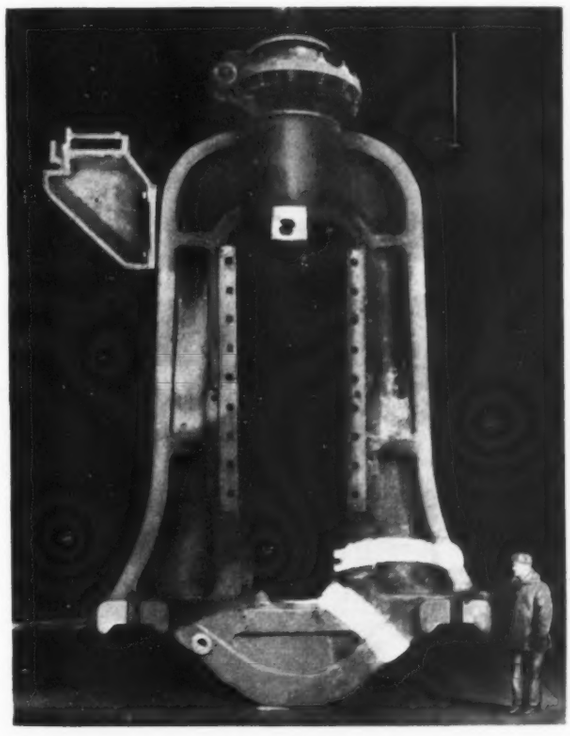
Castings Can be Made Close to Size when Machining with Carboloy

A considerable saving in metal can be made when making castings to be machined with cemented-carbide tools, says the Carboloy Co., Inc., Detroit, Mich. This is because the depth of surplus metal ordinarily provided in castings as an allowance for machining can be reduced. In making sand castings, it has been customary, due to the hard, tough scale, to provide sufficient surplus metal to permit the tool to take a deep cut under the scale. This is essential when using steel tools, because of the excessive tool wear which occurs when light cuts are taken through the highly abrasive tough scale; but it increases the weight of the castings considerably.

Because of the hardness of cemented-carbide tools, however, and their ability to resist abrasive wear, it is possible, with these tools, to take very light cuts just under the scale of sand castings. A typical example illustrates this point. A well-known manufacturer of air brakes adopted one 5-inch and two 7-inch Carboloy cutters for milling two types of cast-iron valve bodies. It was found that with Carboloy, the casting size could be reduced 1/16 inch on all faces to be milled. The result is a net annual saving of over $4500. The Carboloy blade cost for the yearly production of these parts is about $145, based on an average of 3200 pieces per grind and 0.005 inch of stock removed in grinding.

* * *

Do not make the common mistake of assuming that a reserve account is a real reserve. It is not, and the name is a misnomer unless cash is set up in a reserve fund. A reserve *account* is a liability. A reserve *fund* is an asset. They are as wide apart as the poles. Be sure your reserve is a fund, not an account.—*Robert Scudder Denham, The Denham Cost-finding Co.*



One of the Largest Thermit Repair Jobs Ever Made. The Broken Part is a Housing of a 160-inch Plate Mill in a Midwest Steel Mill, the Casting Weighing 164,000 Pounds and being Nearly 22 Feet High, 15 Feet Wide at the Base, and 10 Feet Wide at the Top. Four Tons of Thermit Were Used in Making the Two Welds. It is Obvious that the Cost of the Welds was Only a Fraction of the Cost of a New Housing.

Long Service Records in the Chevrolet Plants

it has often been stated by those who are not well acquainted with industry that men over forty or forty-five years old cannot find employment in industry, particularly in automotive plants. If those making these statements would visit some of our automobile plants, as well as other industrial shops, they would be surprised to find in these shops a great many men advanced far beyond that age limit.

A striking example of this came to our attention when we learned of the delegation of twenty-four workmen who were recently sent by the Chevrolet Motor Co. from the company's other plants to the new plant just opened in Baltimore, for the purpose of giving them an opportunity of visiting and inspecting the new plant. These men represented practically all of the major manufacturing operations necessary in the building of an automobile—foundry, forge, machine shop, and assembly plants. The average age of these twenty-four veterans, who thus received special recognition for long service, was seventy-one years. No more striking refutation could be presented of the statement that the automobile industry has no place for workers who have passed forty.

Jim Thayer, eighty-three years old, was the dean and spokesman for the group. He started in 1915 with the Mason Motor Co., which was then building engines for Chevrolet cars. From 1916 to 1918 he installed all the lineshafting in what is now the Chevrolet plant No. 4 in Flint.

Philip Lawler, eighty years old, became an inspector with Chevrolet in 1916, and still recalls the excitement when fifteen cars came off the assembly line in one day! He now operates a grinding machine for grinding parts for water pumps. All of these men are shop men engaged in blacksmithing and forging, power press work, the operation of machine tools, and inspection.

Five of the Twenty-four Veteran Employes of the Chevrolet Manufacturing and Assembly Plants Who Were the Guests of the Company at a Specially Arranged Inspection of the New Baltimore Assembly Plant of the Chevrolet Motor Co.

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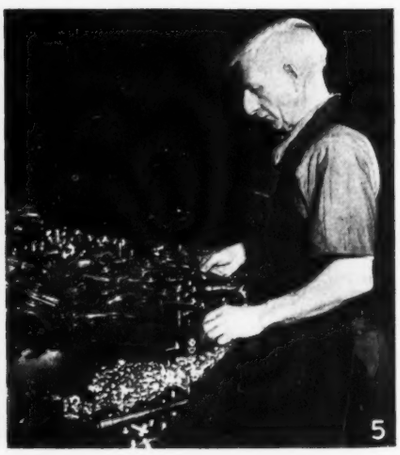
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These Veteran Chevrolet Employes are: (1) Frank Granger, Sixty-nine Years; (2) Charles Keiser, Sixty-nine Years; (3) William Shutt, Seventy-eight Years; (4) David D. Watson, Seventy-two Years; (5) Harry Johnson, Sixty-four Years.

A Machine Shop on Wheels

What is believed to be the largest and most complete mobile machine shop ever designed was recently built by the Marmon-Herrington Co., Inc., Indianapolis, Ind., builders of all-wheel-drive trucks and truck-tractor equipment. This mobile machine shop, as shown in the accompanying illustrations, consists of a Marmon-Herrington tractor with all six wheels driving, and a large semi-trailer in which is contained, in compact and easily accessible form, quite a complete assortment of modern machine shop equipment. A large tent, 80 feet long and 45 feet wide, forms part of the equipment, so that when the shop trailer has been opened up, the shop is still protected from the elements.

The equipment in this movable machine shop includes a gasoline-driven motor-generator set; an air compressor for operating riveting hammers and other compressed air tools; a water pump and water storage tank; a 200-ampere electric welder; a heavy-duty drill press; a universal milling machine; a heavy-duty lathe; a bench grinder; a bearing bushing press; a valve refacer; steam vulcanizing equipment; a portable blacksmith shop which can be removed from the trailer and set up near by; and a set of drawers and lockers with drills, reamers, taps, dies, micrometers, wrenches, carpenters' tools, and other small tools required in the field.

* * *

A Suggestion System that Works

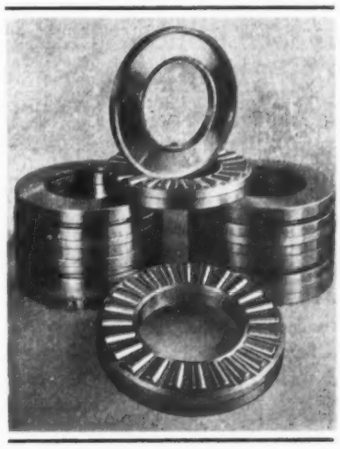
The suggestion system of the General Electric Co. has operated successfully for many years. The annual suggestion report of the company for 1934 shows that 11,438 suggestions were made by employes during the year and that 3736 of these suggestions were adopted. For the adopted suggestions, the company paid to employes $29,218 during the year. In total, $475,000 has been given to employes for accepted suggestions since the system was put in effect nine years ago. The largest single award ever made was $1200; the average award, during a period of years, has been about $10.

Soviet Machine Tool Industry

According to an article published in the British publication MACHINERY, the production of machine tools in Russia increased from 7113 in 1930 to 19,763 in 1934. At a recent exhibition held in Moscow, 120 different types and sizes of machine tools were shown, selected from 183 different types and sizes now being made in the Soviet Republics. These include engine lathes; turret lathes; four-spindle automatics; milling machines; planers; boring, milling, and drilling machines; gear shapers; gear generating machines; centerless grinders; cylindrical grinders; surface grinders; and cold saws.

In 1930 there were six factories in the Soviet Republics that specialized in machine tools and ten others that built machine tools along with other products. At present, there are twelve large factories producing machine tools exclusively and thirty-six other factories also making machine tools on a fairly large scale along with other products. The quality of the machines is said to have greatly improved in recent years.

A Traveling Machine Shop with Full Equipment for Handling Any Ordinary Repair Requirements



Thrust Bearings Designed to Carry a Load of 1,000,000 Pounds Each. They are Fitted with Conical Rollers and Measure 24 1/2 Inches Outside Diameter by 4 9/16 Inches in Thickness.

Thirty-Six of the Bearings Here Illustrated were Made by the Bantam Ball Bearing Co., South Bend, Ind., for Installation in the Lifting Mechanism of Cylinder Gate Hoists at Boulder Dam.

New Ideas of Employes Aid Management

Many shops are operating suggestion systems with considerable success. To be effective, however, these systems must be carefully planned and based on the utmost fairness and consideration. Now that business is gaining momentum, it is a good time to consider the installation of a suggestion system. Many a man in the shop has ideas that he feels will be helpful in improving the efficiency of operations, cutting out waste of time, effort, or material, or otherwise advancing the mutual interests of the plant and the workers. A suggestion system provides an opportunity for employes to help improve shop operations, thereby serving both themselves and the firm.

Men who have risen from the bench or machine to executive positions in the industry know that the man in the shop has unusual opportunities for observation and thought, and that he has many constructive ideas that would be valuable if put into operation. They also know that every wide-awake employe desires an outlet for his ideas, and hopes for some recognition of his contribution. The important point in devising a suggestion plan is to insure that the ideas will be accepted and handled in such a manner as to avoid any possible embarrassment to the man making the suggestion, should his idea be considered impracticable.

Every suggestion should be given careful and impartial consideration, and the conclusion reached by those who pass on the suggestion, together with the reasons on which the conclusion is based, should be given in written form to the employe that made the suggestion. Suitable awards must be provided for suggestions that are adopted. In addition, one company that has been especially successful in conducting a suggestion system, offers special prizes at the close of each six-month period to employes who have made the three best suggestions adopted during the period. In making the awards, consideration is given to three factors —originality of suggestion, improvement in methods effected, and savings resulting from the adoption of the idea.

No special blank should be required for submitting suggestions, but it should be made clear to the employes that in making a suggestion, a man must explain fully what the idea is, how he expects it to work in practice, and what he believes it may accomplish. Sketches and drawings should accompany the suggestion whenever they will help to make the idea clearer. As a rule, these sketches and drawings must be made on separate sheets of paper.

In some plants, the suggestions are offered under an assumed signature. When this is done, announcements are made on a bulletin board of the suggestions that have been accepted and are ready to be returned with explanations. The employe is then in a position to identify himself. In other plants, each suggestion is required to be signed with the employe's name, although the committee passing upon the suggestions treats this information as confidential, and will not reveal the name of the employe without his consent.

Some of the largest companies in the country have made use of suggestion systems with notable success. One company, commenting on the system, said: "Two years' experience with the suggestion system has proved it to be a worthwhile and practical medium for encouraging constructive interest in the company's welfare."

* * *

N.M.T.A. to Meet in Cleveland

The thirty-seventh annual convention of the National Metal Trades Association will be held at the Hotel Cleveland, Cleveland, Ohio, Wednesday and Thursday, May 15 and 16. Among the timely subjects to be discussed are: "An Appraisal of the NRA"; "Practical Treatment of Industrial Relations Problems"; "Prosperity and Social Security"; "The Washington Situation"; "The Economics of the New Deal"; "Americanism and Communism"; and "Where Do We Go from Here"?

* * *

Tool Engineers Elect Officers

The American Society of Tool Engineers, with headquarters at Detroit, Mich., has elected the following officers to serve for the coming year: President, Robert M. Lippard, Heald Machine Co.; first vice-president, Ford R. Lamb, Consolidated Machine Tool Co.; second vice-president, W. Maxwell Gray, Congress Tool & Die Co.; treasurer, B. L. Diamond, Duplex Engineering Co.; and secretary, Albert M. Sargent, Pioneer Engineering & Mfg. Co.

Color Marking for Steel

In response to a request from the National Association of Purchasing Agents, the Iron and Steel Division of the Standards Committee of the Society of Automotive Engineers appointed a subcommittee to consider the advisability of adopting a standard color designation for marking steel bars. The committee considering this question reported that it is not considered practical to adopt such standard colors. The committee stated that it "believes that individual companies should experience no difficulty in having their various types of steel bars painted the proper colors for their individual requirements—in other words, continuing with their present practice rather than attempting to work to some standard color code such as suggested. It is the opinion of the subcommittee that a great many large users of steel in this country would not change their present color code scheme, regardless of any action by the Society, considering that more distinctive colors can be used on their own materials because of the lesser number of types of steel used in their own plants.

"A color code covering the very large number of S A E steels listed would be so extremely complicated, due to the small number of colors that can be used, that a great deal of confusion would surely result, should the Society attempt to cover all of these types of steels. The matter of painting bars while hot would also complicate matters.

"The subcommittee, therefore, reports that it is not deemed practical to adopt a color code as proposed by the National Association of Purchasing Agents, for the marking of steel bars."

The recommendation by the committee was submitted to the entire Division and was approved by it.

* * *

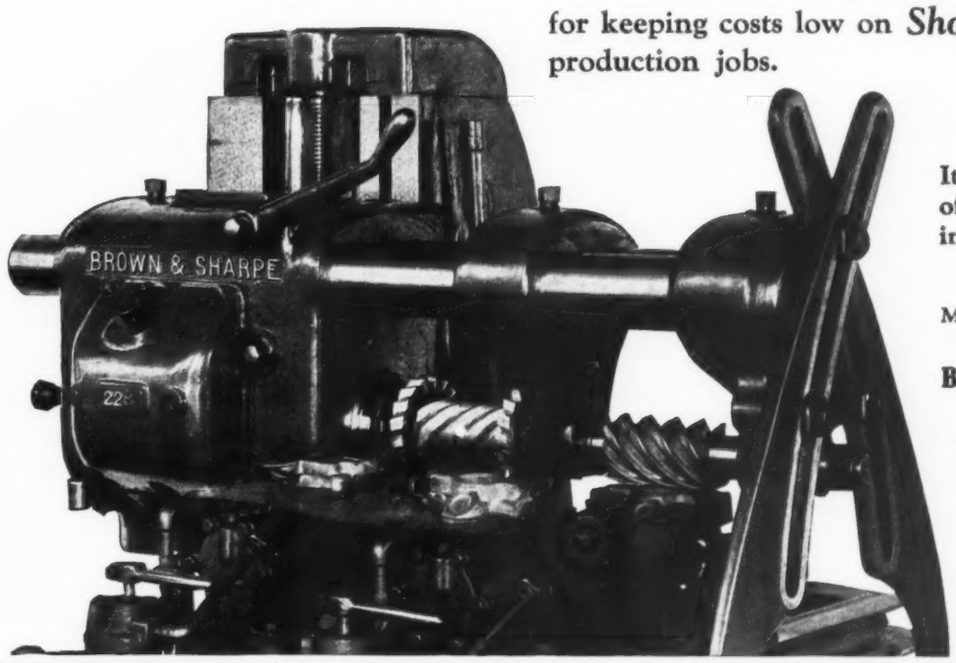
Export Trade in Industrial Machinery in 1934

The exports of industrial machinery during 1934 amounted to $98,348,000, a gain of 78 per cent over the 1933 total of $55,282,000. The increase in the exports of power-driven metal-working machinery over 1933 was especially noteworthy; the value in 1933 was $8,158,000 while in 1934 it reached $19,434,000. There was also an increase in every other group of industrial machinery.

Meet Modernization's Challenge with a No. 22

that not only IMPROVES PRODUCTIVE CAPACITY *but also* REDUCES NON-PRODUCTIVE TIME

Investigate this modern milling machine having the ***Flexibility*** of ***Control*** of the Column and Knee design . . . combined with the ***Production Advantages*** of the Bed Type machine . . . . a high production unit, quickly set up, for keeping costs low on ***Short*** and ***Long*** production jobs.



It will pay to learn of its advantages in lowering production costs.

May we send details?

Brown & Sharpe Mfg. Co.
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BROWN & SHARPE No. 22 PLAIN MILLING MACHINE

NEWS OF THE INDUSTRY

Illinois

C. B. NOLTE, president of the Robert W. Hunt Co., Chicago, Ill., has resigned to accept the presidency of the Crane Co., of Chicago. JAMES C. OGDEN, formerly vice-president in charge of the company's eastern and foreign activities at New York, will succeed Mr. Nolte as president. F. M. RANDLETT, previously Pacific Coast manager of the company, has been appointed vice-president and general manager. M. H. MERRILL will become western manager at San Francisco. Mr. Merrill has been president of M. H. Merrill & Co., consulting engineers, since 1919, and during the last three years has served the Robert W. Hunt Co. as consulting engineer at San Francisco.

RALPH A. TERRELL has recently joined the Ingersoll Steel & Disc Co. Division of the Borg-Warner Corporation, at the West Pullman (Chicago) plant, as chief engineer, succeeding S. S. BATTLES, who has become president of the Midwest Stamping & Enameling Co., Morrison, Ill. Mr. Terrell was formerly superintendent and chief engineer of the South Bend Tool & Die Co., South Bend, Ind.

C. B. BURNS MACHINERY CO., Chicago representative of the South Bend Lathe Works, has moved from the Machinery Hall Building, Clinton and Washington Sts., Chicago, Ill., to 541 W. Washington Blvd., Chicago.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has appointed the R. G. MOELLER CO., 14415 Meyers Road, Detroit, Mich., distributor of Link-Belt crawler shovels, cranes, draglines, and locomotive track-type cranes.

DIAMOND CHAIN & MFG. CO., 409 Kentucky Ave., Indianapolis, Ind., has appointed Hagerty Bros., 923 S. Washington St., Peoria, Ill., distributors for Diamond roller chain, sprockets, and flexible couplings.

REEVE-FRITTS CO., dealer in metalworking machinery, announces the removal of the company from 121 N. Jefferson St., Chicago, Ill., to 28 N. Clinton St., Chicago.

WACHS-GREGG & CO., dealers in drilling machines, shapers, and lathes, have moved from 117 N. Jefferson St., Chicago, Ill., into new quarters at 1535 Dayton St.

STERLING PRODUCTS CO., announces its removal from 631 Washington Blvd. to 117-121 N. Jefferson St., Chicago, Ill.

Michigan

THOMAS PROSSER & SON, 15 Gold St., New York City, importers and distributors of Widia cemented carbides, announce the opening of a new office at 7310 Woodward Ave., Detroit, Mich. E. R. S. REEDER will be district manager in charge of the Detroit office.

K. H. CRUMRINE has joined the sales engineering staff of the Sterling-French Machinery Co., New Center Building, Detroit, Mich. Mr. Crumrine was formerly Detroit sales representative for the Sundstrand Machine Tool Co., Rockford, Ill., and will continue to handle Sundstrand products in his new connection.

UNITED CHROMIUM, INC., has moved its Detroit office and laboratory to larger and more conveniently located quarters at 2751 E. Jefferson Ave.

ALFRED K. MARTIN has been appointed vice-president, director, and chief engineer of the Forging & Casting Corporation, Ferndale, Mich., a subsidiary of the Ludlum Steel Co., and is severing his connection with the latter company, of which he has been vice-president for the last five years. Mr. Martin is a graduate of the Rensselaer Polytechnic Institute, with the degree of Civil Engineer. He has been associated with the Ludlum organization since 1909 and has steadily advanced, having held, successively, the positions of assistant superintendent, superintendent of rolling mills, chief engineer, general superintendent, and vice-president in charge of research and development.

Alfred K. Martin, Vice-president and Chief Engineer of the Forging & Casting Corporation

John R. Tillman, Chief Executive Engineer of the Bullard Company

New England

JOHN R. TILLMAN, for several years head of the tool engineering division of the Bullard Co., Bridgeport, Conn., has recently been appointed assistant to Dudley B. Bullard, vice-president in charge of engineering. In Mr. Tillman's new capacity as chief executive engineer, he will have supervision over all the departments of engineering.

KARL F. BERGER recently became associated with the Grilley & Haven Mfg. Co., 932 Barnum Ave., Bridgeport, Conn., manufacturer of sheet metal specialties, in the capacity of manager. Mr. Berger was formerly superintendent of the 4 D Co., of Bridgeport, in charge of construction of the Dymaxion three-wheel car, and previous to that connection, was with the Waterbury Mfg. Co., Waterbury, Conn., in the engineering department, engaged in tool designing.

REVERE COPPER & BRASS, INC., Taunton, Mass., announces the removal of the Boston office from 250 Stuart St. to 138-164 Federal St.

New York and New Jersey

TRIPLEX MACHINE TOOL CORPORATION, 125 Barclay St., New York City, has appointed the following dealers as exclusive representatives in the United States and Canada for the sale of the jig boring machines and equipment manufactured by the Société Genevoise d'Instruments de Physique, of Geneva, Switzerland: Walter S. Ryan Co., Royal Oak, Mich.; F. W. Schiefer Machinery Co., Rochester, N. Y.; Neff, Kohlbusch & Bissell, Chicago, Ill.; W. E. Shipley Machinery Co., Philadelphia, Pa.; Black-